SCIENCE

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; J. LE CONTE, Geology; W. M. DAVIS, Physiography; O. C. MARSH, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoology; S. H. SCUDDER, Entomology; N. L. BRITTON, Botany; HENRY F. OSBORN, General Biology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; J. MCKEEN CATTELL, Psychology; DANIEL G. BRINTON, J. W. POWELL, Anthropology.

FRIDAY, DECEMBER 4, 1896.

CONTENTS:

*THE JURASSIC FORMATION ON THE ATLANTIC COAST.**

THE absence of all Jurassic strata in the eastern part of the United States has been generally regarded as a settled point in geology for half a century or more. The reason for this vacancy has also been one of the problems geologists have had to deal with, since the formations above and below are well represented. Until a comparatively modern date, this supposed absence of Jurassic deposits was thought to be true, also, for the rest of this country. I well remember the parting advice given me by an eminent professor of geology with whom I studied in Germany:† "The first thing you should do on your return to America is—look for the Jurassic formation. I am sure it is there, full of fossils." This advice I followed, and on my first visit to the Rocky Mountains, in 1868, I found this formation near Lake Como, Wyoming, well developed, and containing an abundance of typical fossils. As this locality is now a famous one, I have brought here a colored drawing that shows the characteristic variegated strata of the Como Bluff, from which so many remains of

* Abstract of Communication made to the National Academy of Sciences, New York meeting, November 18, 1896.

† Ferdinand Roemer, whose researches here had already added much to our knowledge of the geology and paleontology of this country.

Jurassic vertebrates have been taken during my long explorations there.

The base of this section is a red sandstone, apparently of Triassic age. Next above are Jurassic marine beds, with many invertebrate fossils and a few remains of reptiles. Over these beds is a series of peculiar, highly colored clays of fresh-water origin and considerable thickness, rich in vertebrate fossils. Crowning all is the characteristic Dakota sandstone, generally considered of Cretaceous age. The position of this series of strata in the geological scale is shown in the section below, which represents especially the succession of vertebrate life in the West during Mesozoic and Cenozoic time.

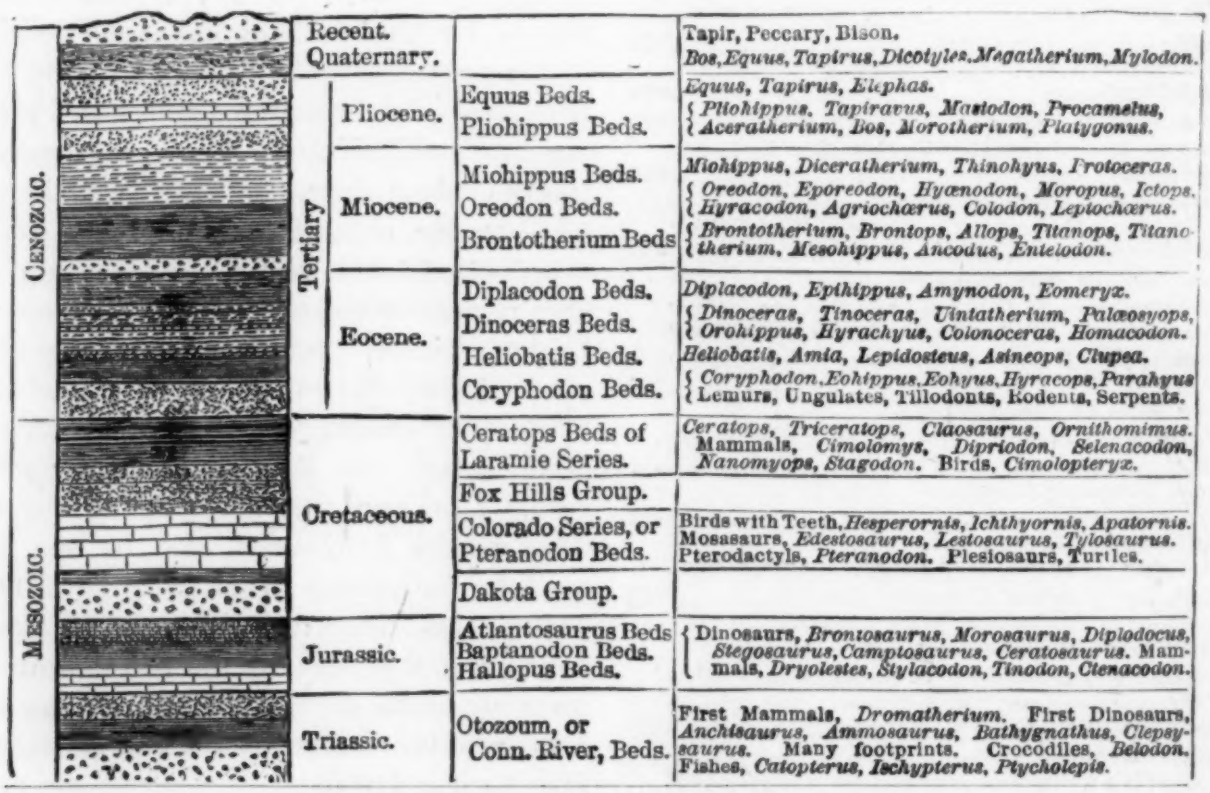


FIGURE 1.—Geological Horizons of Vertebrate Fossils.

THE BAPTANODON BEDS.

The same marine beds that constitute the base of the Como Jurassic series, Meek had previously identified near the Black Hills, by means of invertebrate fossils (Proc. Acad. Nat. Sci., Phila., Vol. X., pp. 41–59, 1859). I found these deposits again in 1870, near the Green River in Utah, and since then at various other points. These strata I have named the Baptanodon beds, from a genus of large swimming reptiles entombed in them.

THE ATLANTOSAURUS BEDS.

The extensive fresh-water deposits of Jurassic age that lie over the marine strata at Como, I have called the Atlantosaurus beds, from a gigantic Dinosaur especially characteristic of the horizon. Other Dinosaurs, large and small, and a great number and variety of vertebrate fossils—mammals, birds, reptiles and fishes—I have likewise secured from this locality and at several other points in the same horizon, chiefly in Wyoming and Colorado. Among these extinct forms, the gigantic *Sauropoda*, the largest of all land animals, are the most wonderful, and are known only from the Jurassic. They are therefore of special value as evidence of geological age.

The main physical features of the Juras-

sic strata in the West, especially the variegated fresh-water deposits, are so striking that, once seen, they will not soon be forgotten. As these physical characters may be used as one means of readily identifying this horizon, I have brought here, besides the colored drawing of the Como section in Wyoming, two others illustrating sections in Colorado. One is from Morrison, near Denver, and the other one hundred miles farther south, near Cañon City, both representing, in the Atlantosaurus beds, localities famous for the vertebrate fossils they have furnished. I know of no other geological horizon in the West marked by such striking and characteristic physical features.

THE PLEUROCŒLUS BEDS.

In the East, the strata most resembling the Atlantosaurus beds in physical characters are the Potomac clays and sands so conspicuous between Washington and Baltimore, and known to extend, also, both to the north and south. Although fifteen hundred miles to the eastward, these Maryland strata so strongly recalled those I had explored at the base of the Rocky Mountains, I felt reasonably sure, even before I had examined them, that this series would turn out to be essentially the same age as the Atlantosaurus beds of the West. This proved to be the case. Although the Potomac beds have been generally regarded as Cretaceous, I can now safely say that the vertebrate fossils I have secured from them, especially the *Sauropoda*, demonstrate their Jurassic age beyond reasonable doubt. I stated this conclusion in my first description of Potomac fossils, and it is now fully confirmed by more recent discoveries.*

The fact that the *Sauropoda* of the Potomac beds are all of diminutive size, in comparison with the western forms, is a point of some importance in estimating the age of the strata that contain them. It is a rule almost without exception, that the earlier members of an order of ancient vertebrate animals are small, while the last survivors before extinction are the largest. The gigantic forms of every such group left no successors. Hence the small *Pleurocœlidæ* of the East may possibly be the ancestors of of the huge western *Atlantosauridæ*, but can hardly be their descendants. The other vertebrate fossils from the Potomac of Maryland, although fragmentary, all appear to be Jurassic in type.

It cannot, of course, be positively asserted at present that the entire series now known as Potomac is all Jurassic, or represents the whole Jurassic. The Lias appears to be wanting, and some of the upper strata may possibly prove to belong to the Dakota.

The latter formation in the West often lies apparently conformably on the Atlantosaurus beds, and besides its many fossil plants contains fragments of bones, but these may have washed out of the Jurassic clays below. Footprints resembling those of birds have also been found.

THE POTOMAC FORMATION.

The Maryland Potomac, as we know it to-day, is the keystone to the arch. If this is Jurassic, as now seems certain, it is a fair conclusion that the same series of deposits, north and south, are essentially of the same age. The only region along this line of a thousand miles or more where a systematic search for vertebrate fossils has been made is in Maryland, and here a rich fauna has been found. Doubtless in many outcrops of this formation, animal remains may be rare or absent, as they appear to be in the Triassic below, but vertebrate life we know was abundant during the Jurassic, and characteristic remains will sooner or later come to light.

Taking, then, the Potomac formation as it is developed in Maryland as an eastern

* *American Journal of Science*, Vol. XXXV., p. 90, 1888. See also, Sixteenth Annual Report U. S. Geol. Survey, Part I., p. 183, 1896.

representative of the Jurassic, let us see what follows. The authorities on this formation—McGee, Ward, Fontaine, Uhler and others—agree that it extends south along the Atlantic border as far as North Carolina, holding the same relative position and the same general characteristics. That it also extends west around the Gulf border has been asserted by those most familiar with its southern development, but on this point I cannot speak from personal observation.

From the Potomac River northward, however, I have made sufficient explorations along its outcrops through Maryland, Delaware and Pennsylvania, to the Delaware River, to ascertain its distinctive features, essentially the same throughout, with its geological position still maintained. In New Jersey I have likewise followed its equivalent strata across the State in the great series of variegated plastic clays, to the Raritan River, and again in their exposure on Staten Island, everywhere seemingly the same series of strata and of the same age. The position is a definite one, always along the line where the Jurassic must lie, if present.

Along the northern shore of Long Island, the same formation extends, and at many outcrops it may be seen with its characteristic features well displayed. I have recently examined these exposures at many points, and all tell the same story. At Montauk Point and on Gardiner's Island I found apparently the same deposits, but with local variations that need not now be discussed.

Block Island, evidently once a part of Long Island, I have also examined. Its basal clays agree in most respects with the above representatives of the same horizon, as I have shown elsewhere.*

*American Journal of Science, Vol. II., p. 295, October, and p. 375, November, 1896. In the second paper will be found an abstract of the more important literature.

GAY HEAD.

By far the finest exhibition of the great formation in question may be seen on Martha's Vineyard, especially at Gay Head, which for a century has attracted the attention of geologists, who have tried in vain to solve its mysteries. My first visit to this classic region was in September last, and I know of no point on the Atlantic coast, from Nova Scotia to Florida, of more interest to geologists. The striking resemblance between the variegated cliffs at Gay Head, the Potomac hills in Maryland, and Como bluffs in Wyoming, will impress everyone who has seen them. That all three are of essentially the same geological age, I have good reason to believe. Two of them are certainly Jurassic, as demonstrated by typical vertebrate fossils, and I hope soon to prove that Gay Head, so similar in all other respects, also contains the same characteristic vertebrate fauna that marks the Jurassic—the long missing formation on the Atlantic coast.

It has already been shown that the vertebrate fossils of the Potomac in Maryland prove its age there to be Jurassic, especially when taken in connection with the rich fauna of the Atlantosaurus beds of the West. In determining the age of the whole series, every aid that paleontology can render should be brought to bear upon the question, but a discrimination greater than has hitherto been shown is necessary to secure the best results.

In addition, then, to the evidence of vertebrate fossils as to the age of this eastern formation, the testimony of the invertebrates and plants should also be considered. The invertebrates known from these strata are few in number, but some of the mollusks among them point to the Jurassic age, as Whitfield has shown.* Nearly all, however, were estuary or fresh-water forms, which are now generally admitted to be of

* Monograph IX., U. S. Geol. Survey, p. 23, 1885.

slight value as witnesses of geological changes.

EVIDENCE OF FOSSIL PLANTS.

Remains of plants are numerous, but usually fragmentary, and these have been collected at many localities, and studied by botanists of much experience in such investigations. The verdict they have rendered has not been a unanimous one, but is especially interesting, as it coincides at one point with the decisions some of their predecessors have rendered as to the age of other geological horizons in the succeeding formations of the West.

The horizons I especially refer to are in the Dakota, Laramie and Eocene, all essentially of lacustrine origin, and now well known. Fossil plants in good preservation have been collected in each of these in turn, and pronounced by eminent botanists to be Miocene. Other paleobotanists of equal eminence have reviewed the evidence and made the age somewhat older, but, as a rule, the conclusion reached made the deposits in question at least one period later than the animal remains indicated. To explain this discordance, it was in one case gravely asserted that a Cretaceous vertebrate fauna lived in the midst of a Tertiary flora. A larger knowledge of the facts has since led to revision of the first opinions on this point, and the Cretaceous age of both is now admitted.

It seems to me extremely probable that in the Potomac formation we again have an analogous case. The botanists have pronounced the plants Cretaceous, while the vertebrates are certainly Jurassic. Change the botanical scale one notch, as was done in the horizons above, and the flora and fauna agree, while the Jurassic formation, so long missing, is in its proper place on the Atlantic coast as it is in the West. The North American botanical timepiece was originally set by the European clock, which was one period too slow, as many facts now indicate. Sooner or later, an adjustment must be made.

AGE OF THE WEALDEN.

To illustrate this, I may mention, as the latest change in the European time-standard, the Wealden formation, the Cretaceous age of which has long been considered a settled point. I had studied this formation at many localities in England and on the Continent, as it contained a reptilian fauna similar to one I had found in the Rocky Mountains and regarded as Jurassic. A further study of the Wealden reptiles caused me to question their Cretaceous age, and a comparison of these with allied forms from the Rocky Mountains led me to the conclusion that both series were Jurassic.

At the meeting of the British Association, at Ipswich, last year, I read a paper on European Dinosaurs, including two from the Wealden, and thus the question of their geological age came up for determination. The facts I presented, based mainly upon the reptilian fauna, strongly indicated the Jurassic age of the Wealden, and I urged a re-examination of the question by English geologists.* The subject has since been taken up by Smith Woodward, with special reference to the fossil fishes, on which he is high authority. In the *Geological Magazine* for February, 1896, he gives the main results of his investigation, which prove that the fishes, also, of the Wealden are of Jurassic types, thus placing the geological age of this formation beyond reasonable doubt.

The same conclusion, based upon a review of the Wealden plants, has recently been reached by A. C. Seward, likewise an eminent authority, who states the case as follows: "The evidence of paleobotany

* Report British Association for the Advancement of Science, p. 688, 1895; and *American Journal of Science*, Vol. L., p. 412, November, 1895.

certainly favors the inclusion of the Wealden rocks in the Jurassic series."*

AGE OF THE LARAMIE.

The problem before us to-day has a strong family resemblance to another with which geologists were face to face twenty years ago; namely, the geological age of the great lignite series of the West. Then, as now, the plants and the animal remains seemed to tell a different story, and I was thus led to investigate the question with considerable care. It may perhaps aid in solving the present problem if I repeat what I then said so far as it relates to the value of different kinds of fossils as evidence of geological age. In an address before the American Association for the Advancement of Science, in 1877,† I stated the case as follows:

"The boundary line between the Cretaceous and Tertiary in the region of the Rocky Mountains has been much in dispute during the last few years, mainly in consequence of the uncertain geological bearings of the fossil plants found near this horizon. The accompanying invertebrate fossils have thrown little light on the question, which is essentially whether the great Lignite series of the West is uppermost Cretaceous or lowest Eocene. The evidence of the numerous vertebrate remains is, in my judgment, decisive, and in favor of the former view.

RELATIVE IMPORTANCE OF FOSSILS.

"This brings up an important point in paleontology, one to which my attention was drawn several years since; namely, the comparative value of different groups of fossils in marking geological time. In examining the subject with some care, I found that, for this purpose, plants, as their nature indicates, are most unsatisfactory witnesses; that invertebrate animals are much better; and that vertebrates afford the most reliable evidence of climatic and other geological changes. The subdivisions of the latter group, moreover, and in fact all forms of animal life, are of value in this respect, mainly according to the perfection of their organization or zoological rank. Fishes, for example, are but slightly affected by changes that would destroy reptiles or birds, and the higher mammals succumb under influences that the lower forms pass through in safety. The more special applications of this general law, and its value in geology, will readily suggest themselves."

In the statement I have quoted I had no intention of reflecting in the slightest degree on the work of the conscientious paleobotanists who had endeavored to solve the problem with the best means at their command. I merely meant to suggest that the means then at their command were not adequate to the solution.

It so happened that the most renowned of European botanists, Sir Joseph Hooker, was then in this country, and to him I personally submitted the question as to the value of fossil plants as witnesses in determining the geological age of formations. The answer he made fully confirmed the conclusions I had stated in my address. Quoting from that, in his annual address as President of the Royal Society, he added his own views on the same question.* His words of caution should be borne in mind by all who use fossil plants in determining questions of geological age, and they are especially applicable to the problem now before us—the age of the Potomac formation.

The scientific investigation of fossil plants is an important branch of botany, however fragmentary the specimens may be. To at-

* Catalogue British Museum, Wealden Flora, p. 290, 1895.

† *American Journal of Science*, Vol. XIV., pp. 338–378, November, 1877.

* Proceedings Royal Society of London, Vol. XXVI., pp. 441, 443, 1877.

tempt to make out the age of formations by the use of such material is too often labor lost and must necessarily be so. As a faithful pupil of Goeppert, one of the fathers of fossil botany, I may perhaps be allowed to say this, especially as it was from his instruction that I first learned to doubt the value of fossil plants as indices of the past history of the world. Such specimens may indeed aid in marking the continuity of a particular stratum or horizon, but without the reinforcement of higher forms of life can do little to determine the age.

The paleobotanists have certainly failed repeatedly in the past in attempting to define geological horizons by fossil plants alone. Although they have this record as a guide, some of them are still using the same methods, the same material, with the same confidence, that formerly misled their predecessors. In view of this, and of the great importance of the present question, is it too much to ask them to reconsider their verdict as to the age of the Potomac formation?

Were the fossil plants of the Potomac that have been pronounced Cretaceous unknown, the Jurassic age of this extensive series would have been accepted as a matter of course long ago. The strata themselves lie exactly in the position the Jurassic should occupy. They agree in physical characters more closely with the shallow fresh-water shales and sandstones of the Trias below than with the deep-sea Cretaceous beds above. Still more important, the animal remains taken together, invertebrates and vertebrates, indicate one fauna, the Jurassic. Under these circumstances the plants alone cannot finally decide the age.

POSITION OF JURASSIC STRATA.

In the geological section, Figure 1, on page 806, the relative position of the Jurassic deposits of the West is designated, and this will hold good for all the strata of that age in known localities on both flanks of the Rocky Mountains. In the East the position of the deposits here regarded as Jurassic is equally definite, and corresponds strictly to that of the western horizon in its most essential features. A reference to the section in Figure 2, below, will make this clear. This typical section is based on one by G. H. Cook, in the Geology of New Jersey,* and represents the successive Mesozoic and more recent formations, from New Brunswick, New Jersey, on a line southeast, through Lower Squankum to the Atlantic. The relative proportions and inclination of the various divisions cannot, of course, be given accurately in so small a figure. The distance represented by this section is about forty miles.

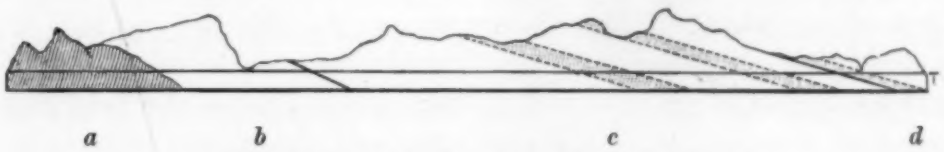


FIGURE 2.—Geological Section in New Jersey.
a, Triassic; *b*, Jurassic; *c*, Cretaceous; *d*, Tertiary; T, tide level.

In this section, the red Triassic shales and sandstones are shown on the left, highly inclined. Resting on their eroded surface are the well-known variegated plastic clays, also of fresh-water origin. These strata are nearly horizontal, having a slight inclination toward the ocean. The top of these peculiar clay beds is not defined, but is marked by a change from lacustrine to marine conditions, which clearly indicate deposition in water of increasing depth, and finally deep-sea glauconite strata. These

*Geological Map, Cretaceous Section 3, 1868.

greensand deposits continued with some interruptions throughout the remaining Cretaceous time, and even into the early Tertiary, the third, or upper, marl bed being Eocene. Over these are strata of Miocene age, the Ammodon beds, and still more modern deposits form the shore of the Atlantic.

ATLANTIC BARRIERS.

The change from the fresh-water plastic clays of New Jersey to the marine beds containing greensand over them proves not only the breaking down of the eastern barrier which protected the former strata from the Atlantic, but a great subsidence also, since glauconite, as a rule, is only deposited in the deep, still waters of the ocean.

The Miocene greensand surmounting the Gay Head clay cliffs on Martha's Vineyard also means the same thing, and a still greater lapse of time, as the whole Cretaceous and Eocene strata are here apparently absent. The present height of these Miocene strata indicates indirectly the minimum of elevation, the depth of the sea in which they were deposited being at present one of the unknown elements. It has been suggested by some geologists that the eastern barrier was composed of granitic rocks, and thus furnished the materials for the New Jersey and other clays.* Many known facts support this view.

The western, or inner, barrier of this great fresh-water border lake is still well marked. In the New England region, the present rock-bound coast line indicates its approximate position, and retains in its bays and inlets remnants of the deposits then laid down. Away from the coast, I know of only a single locality that seems to have preserved these beds, and that is near Brandon, Vermont. This basin I explored long ago, and, if my memory serves me rightly, I saw there the typical clays, lignites, and iron ores, that mark the horizon now under consideration. South of New England, the inner barrier is equally well defined by the Triassic and older rocks to the Potomac River, but beyond that point I have not carefully examined it.

*Geology of New Jersey, Report on Clays, p. 30, 1878.

PHYSICAL CHARACTERS OF THE JURASSIC.

The strong resemblance in their physical characters between the fresh-water deposits here regarded as Jurassic and those long known to be such in the Rocky Mountain region is largely dependent on the materials of which they are formed, and the conditions under which they were deposited. The close correspondence in this respect between the beds of the two regions should have some value in estimating their age.

The most striking feature in these deposits is the variety of colors in the plastic clays. Brilliant red, green, and yellow tints are especially prominent, yet the white and black shades are equally noticeable. While these colors are often seen in great masses, marking definite strata in fresh exposures, they blend one with another from the effects of weathering, where the original colors wash over each other. In the Rocky Mountain region the brilliant hues of the Jurassic strata may be seen for miles on the face of the high bluffs. This is especially remarkable in the cliffs at Como, Wyoming, a representation of which is before you. Still more brilliant effects may be seen in the canyons on the west side of the Green River, in eastern Utah.

East of the Rocky Mountains the same color scheme is well illustrated around the Black Hills, in South Dakota. Again in the foot-hills west of Denver, near Morrison, Colorado, a similar exhibition is to be seen, as represented in the second drawing. This is repeated on a much larger scale further south, near Cañon City, Colorado, as likewise shown in still another sketch, but

none of these colored drawings does justice to the natural scenery.

On the Atlantic coast the same combination of colors, although less brilliant, may be seen in the Potomac outcrops in Maryland, now proved by vertebrate fossils to be likewise Jurassic. Further north the reds predominate in this horizon across Delaware and Pennsylvania, but in the plastic clays of New Jersey the strong, distinct colors, usually in horizontal bands, are dominant. On Staten Island and at various outcrops along the northern shore of Long Island, as well as on Block Island, the same horizon is distinctly marked by variegated patches, while still further east, at Gay Head, on Martha's Vineyard, the most startling color display of the whole Atlantic coast forms a flaming beacon that mariners and geologists alike have for a century held in high esteem. I know of no other horizon of equal extent so readily distinguished from all others by its physical features.

EARLY INVESTIGATIONS.

In the early days of American geology the pioneers here, as in other branches of science, attempted to refer everything to European standards. In this way, strata of various ages, as we now know, were called by European names and were supposed to represent equivalents. In this general way, the terms Lias, Oolite, etc., were applied to strata on the Atlantic coast. It was soon found, however, by the actual workers in the field, that our geological sequence had only a general correspondence with that of Europe or of other parts of the world, yet some geologists still endeavor to harmonize the time tables, but with only moderate success. It is, however, now becoming known that this continent had its own law of development, and that its fauna and flora must be studied by themselves to disclose their full significance. The time ratios of America certainly do not coincide with those of Europe. The long periods of Mesozoic time represented in Europe by great deposition of many series of strata were marked here by other means as well. The rich fauna and flora that then lived here do not have their exact counterparts elsewhere.

The apparent absence on the Atlantic coast of the Jurassic as known in Europe naturally led the early geologists to seek its equivalent strata. The first supposed identification seems to have been recorded by W. B. Rogers, who called the eastern Virginia coal beds Oolitic.* These beds are now regarded as Triassic.

This eminent geologist also referred to the Jurassic certain silicious, argillaceous, and pebbly beds in Virginia and further north, as possibly 'a passage-group analogous to the Wealden of British geology.'† P. T. Tyson in 1860 referred the Maryland clays to the Cretaceous, and later to the Jurassic.‡

Long before this, in 1835, H. D. Rogers, in his sketch of the geology of North America, clearly recognized what is here regarded as Jurassic as pertaining to one great formation. He described this as extending along the tide-water plain of the Atlantic, from the Carolinas through Virginia, Maryland, Delaware, Pennsylvania, and New Jersey, and also as continuing on through Long Island to Martha's Vineyard and Nantucket. He gave it the name of 'Ancient Alluvium,' but included in it the plastic clay formation and part of the Gay Head deposits, the latter of which he considered Cretaceous.§

* Transactions Association American Geologists and Naturalists, Vol. I., p. 300, 1843.

† Proceedings Boston Society, Vol. XVIII., pp. 104, 105, 1875.

‡ 1st Report State Chemist, Maryland, p. 41, 1860; 2d Report, p. 54, 1862.

§ Report British Association, Edinburgh Meeting, pp. 1–66, 1835.

The next noteworthy description of the Jurassic as here defined was given by J. C. Booth in his report on the Geological Survey of Delaware, 1841. He described the variegated plastic clays of that state, and gave to them the name of 'Red Clay Formation,' which he regarded as belonging to the Upper Secondary. The more recent publications on this Atlantic Coast formation are well known, and need not be cited here.

Among the early explorers who contributed to our knowledge of the Jurassic of the Rocky Mountains and Pacific coast region were J. Marcou, in New Mexico, 1853; C. King, in California, 1863; and, in the same State, W. Gabb, 1864, and F. B. Meek, 1865.

The earliest discovery of the Jurassic in the Arctic region of this country was by Sir E. Belcher, in 1852, who found remains of *Ichthyosaurus* on Exmouth Island. The latest information in regard to the Jurassic comes also from the Arctic region, where Nansen has found this formation containing many fossils, near Franz Josef Land.

JURA-TRIAS.

The term Jura-Trias, now in use, is in reality a confession of ignorance, excusable, perhaps, a quarter of a century ago, but unpardonable now in those whose duty it is to map or define the formations of this country. Yet this term is still sometimes used for so clean-cut a Triassic horizon as the Connecticut River sandstone. It is true that in early days of New England geology this formation was in part referred to the Jurassic, but at the present time no one at all familiar with the evidence of the abundant vertebrate life found in it could make such a mistake. This is equally true of the southern extension of the same formation along the Atlantic coast, where it is everywhere quite distinct from the Jurassic. In the West the dividing line is less marked in some regions, but I believe that even there careful explorations alone are required to separate these two allied formations.

VERTEBRATE FAUNA OF THE JURASSIC.

The Jurassic age of the Atlantosaurus beds of the West has now been demonstrated beyond question by the presence of a rich fauna of mammals, birds, reptiles, and fishes. Among these the *Sauropoda* were dominant and the other Dinosaurs well represented.

In the Potomac beds of Maryland the same Jurassic vertebrate fauna is present, as shown by the remains of five different orders of reptiles already discovered in them. Among the Dinosaurs are the *Sauropoda*, the *Theropoda* and the *Predentata*, the first group represented by several genera and a great number of individuals. One of these genera is *Pleurocœlus*, which has also been found in the Jurassic of the West. Besides the Dinosaurs, characteristic remains of *Crocodilia* and *Testudinata* are not uncommon, and various fishes have been found. The remains of these six groups already known are amply sufficient to determine the age of the formation, and still more important discoveries doubtless await careful exploration.

The discovery of vertebrate fossils further east is merely a question of systematic work. That they are there, all experience in this horizon clearly indicates. In 1870 I passed over miles of similar strata on the eastern flanks of the Uinta Mountains, with every man of my expedition on the lookout for fossils, prompted both by zeal for science and a special reward for the first specimen, but also on the alert for the hostile Ute Indians around us, yet not a fossil was seen. Ascending a few hundred feet, I found the sides of a narrow canyon full of fossils, vertebrate and invertebrate, all of Jurassic forms. The stratum once established, the supposed barren clays soon furnished rich localities.

The similar Potomac clays were formerly pronounced quite destitute of animal remains by geologists of eminence, but hard work disclosed their treasures. The coast east of the Hudson has an abundance of the same strata, and offers still greater rewards to explorers. The Gay Head Indians are not hostile, but will be found active assistants in the good work, while holding fast to the traditions of their ancestors as to the volcanic origin of their narrow sea-scourged home.

LONG ISLAND SOUND.

It is evident that we know the remnants only of the great formation we are now discussing, for the larger part of it has long since been swept away, and much of the remainder is covered up or obscured by later deposits. The origin of this formation is a great question in itself, while its gradual destruction offers still larger problems to the geologist. One of these only I have time now to touch upon, and that has special interest for me, as day by day from my study window I look across the Sound to Long Island.

The origin of Long Island Sound was doubtless largely dependent upon the soft Jurassic clays that once filled its bed. The barrier on the north was the rock-bound New England coast essentially as it is to-day. The outer barrier, now removed or beneath the ocean, was perhaps of less durable material, and, as the coast subsided, gradually succumbed to the assaults of Atlantic waves. The great terminal moraine at the close of the glacial period proved a second barrier, and the waters from the melting ice and the larger rivers sought an outlet to the sea, both east and west, and thus a channel was formed in the soft clays and sands that the strong ocean currents gradually enlarged to its present size.

CONCLUSION.

The problem now before us is the presence or absence, on the Atlantic coast, of strata of Jurassic age. The exact position where such deposits should be found, if present, is well known to all geologists familiar with our eastern border. The fresh-water Triassic beds below this position and the extensive marine Cretaceous above have long been carefully studied and their exact limits defined.

For many hundred miles, along the line where the Jurassic should occur, there is a well-marked series of fresh-water clays and sands quite distinct from anything else on the coast, and the question is,—are these beds of Jurassic or Cretaceous age? The prevailing opinion hitherto has been strongly in favor of the latter, although this view separated two allied fresh-water formations, and still left out the great Jura, so well represented in other parts of the world, and especially in our own Rocky Mountain region.

How difficult it is to lay aside preconceived opinions, everyone knows. The long supposed absence of the Jurassic on the Atlantic coast seems to have blinded those who had the formation under their feet. The evidence to-day in favor of its presence, if not conclusive at every point, is vastly greater than the opposing testimony. Moreover, its acceptance explains at once a mystery of long standing—why the records of Jurassic time were not preserved here in their true place.

To call this peculiar Atlantic formation Cretaceous in its various eastern outcrops, when the western expansion of the same characteristic deposits has been proved Jurassic, is certainly not scientific. To do this in the light of present testimony, including the animal remains, vertebrate and invertebrate, the unique structure and materials of the strata themselves, and especially their definite position where the Jura should be, is to violate the laws of evidence.

No geologist familiar with the facts will

sent the filling of holes made by burrowing animals or by the roots of trees. In places there are thin sheets of lime carbonate, which have been concentrated by water from the loess above and deposited in the cracks in the ash.

Deposits near Edison. The ash of this region is four or five miles south of the station. The exposures are but two in number, but much larger than those near Ingham. Their general relations are the same. Where the wall of the valley is steep or vertical the ash appears, but where the slope is gentle, as where the loess has slidden down from above, it was not exposed. The larger of the two exposures near Edison extends along the side of the valley for a distance of several hundred yards, interrupted here and there by a mass of loess which has slumped, locally concealing it. The thickness of the bed is in places more than twenty feet. The ash is more uniform in texture than that near Ingham, there being none so coarse as the coarsest at that point. It seemed to be equally free from foreign matter. A reentrant in the side of the ravine in which the main exposure occurs, shows that the ash runs back from the wall of the ravine where the main exposure occurs, in undiminished thickness.

The second exposure near Edison is about a-half mile from the first and in another valley. The exposure is much less extensive than the first laterally, though nearly as thick. It is very probable that the ash is continuous between the two ravines in which it is exposed.

Deposits near Orleans. The best of the exposures in this locality is near the head of a small ravine tributary to the valley of the Republican river. Its general relations are identical with those of the ash at the other localities. As there, it is covered by loess, and as there, it appears only where the valley slopes are steep and where the loess has not slumped. The exposed part of the deposit here varies in thickness from five to twelve feet, and the ash is very fine and white.

Ash in lesser quantities was seen at several points in the vicinity. In some cases, especially where thin, it is more or less mixed with earthy matter.

At most of these places the ash showed more or less evidence of stratification; but in the faces exposed in 1894, the stratification was not of such a character as to make it altogether certain that the ash was deposited in water. If deposited in water, it must have been at a time when this region was covered with a lake, presumably a late Tertiary lake, to which the wind brought the ash. So far as the relationships of the ash were seen, it was only clear that the ash was deposited, and probably somewhat eroded, before the deposition of the loess, and that the loess was deposited before the valleys in the banks of which the ash is exposed were excavated.

It has long been known that volcanic ash exists in other localities in Nebraska. Some of these were noted long since by Prof. Todd and Mr. Merrill, but, so far as I am aware, no publication has been made of the ash at the localities here mentioned. It may be of interest to add that the volcanic ash from this region has already become an important article of commerce, under the name of pumice. It has been found to be available for all the various uses to which pulverized pumice is put.

ROLLIN D. SALISBURY.
UNIVERSITY OF CHICAGO.

THE MODERN VERSION OF THE LAW OF SUPPLY AND DEMAND.

A MOST interesting illustration of what the writer has called 'The Modern Version of the Law of Supply and Demand' is seen in recently published statistics of the copper production of Lake Superior, given out

deny that the variegated Potomac clays in Maryland are continuous with those in Delaware, Pennsylvania, and New Jersey, and that the similar basal clays on Long Island, and the other islands to the eastward as far as Nantucket, are part and parcel of the same series. There is now positive proof that the southern end of this series is Jurassic, and it is certainly a fair conclusion that the remainder is of the same age. The burden of proof will rest upon those who hold to the contrary.

To place the strata in question in the Jurassic section of the Atlantic coast at once removes many difficulties that have hitherto perplexed students of the Mesozoic of this region. It completes the series, and shows in part, at least, what was done in deposition during that long interval between the end of Triassic and the beginning of Cretaceous time, when the great barrier was broken down, which, from the Devonian to the Cretaceous, shut out the waters of the Atlantic.

I must leave it to others with leisure at their command to work out the details of this well-marked series, and its relation to those above and below. I have no time to devote to the surface geology of this belt or to the earlier deposits of Tertiary time. Just now the Mesozoic interests me most of all, especially its middle section, the Jurassic, as I believe great injustice has been done, since this has been denied its rightful place, and a name not its own stamped upon it.

In a later communication I hope to discuss this question further, and especially the Jurassic beds south of the Potomac River.

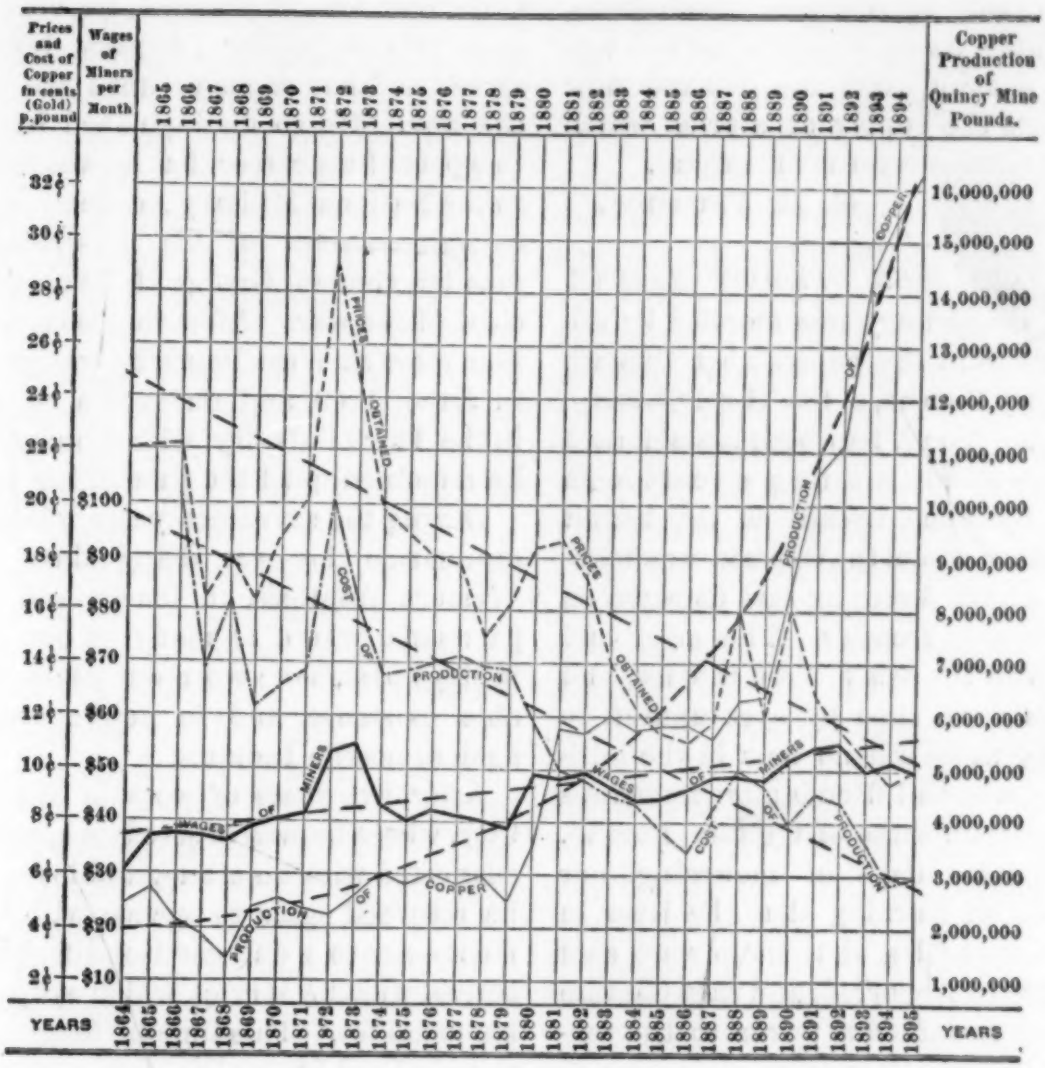
O. C. Marsh.
Yale University, New Haven, Conn.

VOLCANIC ASH IN SOUTHWESTERN NEBRASKA.

In the summer of 1894 I spent two days in southwestern Nebraska in the examination of certain deposits of volcanic ash. These deposits were seen at three localities, viz: 1° near Ingham, Lincoln county; 2° near Edison, Furnas county, about forty-five miles southwest of Ingham; and 3° near Orleans, Harlan county, about twenty miles southeast of Edison. At all of these localities there are several more or less closely associated exposures of the ash. In all cases it appears in the side or near the head of a canyon-like ravine. In the ravines where it occurs it is to be seen only where the walls are essentially vertical, and in all places it is capped by loess. It is probable that the failure of the ash to appear at many points on the sides of the ravines in which it occurs is due to the fact that the loess from above has slumped down, concealing it.

The deposits near Ingham. The volcanic ash near Ingham is exposed at four or five points, the most widely separated of which are less than a mile apart. The first suggestion of the exposures was that the ash formed a continuous layer beneath the loess, and that it failed to appear continuously in the wall of the ravine only because it was locally concealed by the slumping of the loess above it. Further examination, however, showed that this was probably not the fact, for at one point a layer of ash was seen to thin out promptly from a thickness of twenty-two feet to a thickness of four or five.

The ash at this point varies in color from nearly white to a yellow-cream color, on the one hand, and to a light gray, on the other. It varies in grain from the grade of coarse sand to that of fine flour. These grades of coarseness do not appear to be the result of admixture with foreign substances, for no such materials could be detected on the ground, and microscopic examination confirmed the field conclusion. The ash is more or less affected by streaks or pockets of loess which appear to repre-



Relations between wages, prices, costs and quantity.
[*From The Iron Age.*]

mencement of the existing crisis, costs have been on the average, in the copper producing industry, steadily and rapidly diminished by the use of rock drills and high explosives, as well as by diminishing costs of transportation and handling. The reduced costs have permitted reduced prices, which, in turn, have stimulated demand. The enormous quantity of free capital now existing has permitted immediate response to the demand and corresponding increase of supply. And thus, in consequence of the greater influence of invention and improvements in the arts, and especially of the increase of the amount of available capital in these later years, we see what may be termed a reversal of the customary statement of the law of supply and demand, and 'increasing demand produces decreased prices.'

Commenting upon these figures, *The Iron Age* says:

"We need hardly add that these bald figures, eloquent though they be, do not tell the whole tale of the wonderful improvement in the condition of the workingman, when instituting a comparison between the days before the war and those of the last decades. Only he who knows the life of a young mining location in the woods, and of the condition of the communities of the Lake copper region at the present day, can grasp all its significance."

Invention, discovery and general improvement in all the useful arts now con-

by Mr. Stanton, Treasurer of the old Central Mine. This mine has been in operation many years and has continuously supplied the market, in competition with the Calumet & Hecla and other more favored mines, with almost uniform profit; notwithstanding all the fluctuations of business during its now long life. The statistics are published in *The Iron Age*, in a late issue, and may be there consulted for details. The general facts are that, in the words of the 'modern version,' above mentioned, "increase of demand has been accompanied by the decreased costs, due to increased supply and improved methods."

The older version reads: "Increased demand produced increased prices; increased supply gives lower prices." The fact has come to be, in all the great fields of industry in which, as now, ample capital can always be secured for any legitimate enterprise, and especially in those in which invention and the mechanic arts play any large part, that "*Increased demand and an enlarged market, like inventions and discoveries and improved methods, by permitting more economical operation of the system of production, decrease prices.*"

A contract for ten newly invented sewing machines could only be filled to-day, with profit, at a price, we will say, of $100 each; a contract for 10,000 could be filled probably at $10 each. A mine raising 100,000 tons of ore annually must charge more per ton, or accept lower profits, than if its production were a half-million tons, the office and general expenses being then assessed upon the smaller quantity. The fact above stated with reference to copper is true of silver, of gold in less degree, of iron, and of, in fact, all the products of mine and factory, and even of the soil in the long run.

The most generally illustrated action of the law of supply and demand, in recent times, would seem to be the following: Decreasing cost of production gives larger demand and stored capital permits larger supply. This reduced cost is also an element of the change in the case of copper production, which is more influential in causing the curious and interesting economic results observed, as above, in the case of copper, silver and other metals, than is any other. By improved processes and recent inventions the cost of production of the metal has been brought down to about one-half the figures of a generation ago, while the productiveness, and therefore the market value, of the labor engaged in this more efficient production is at the same time increased.

These facts are also shown in the accompanying diagram, which is reduced from the figures of the Quincy mine. It is seen that the introduction of improvements of methods and economics in various directions has produced a constant and a fairly steady diminution of prices in the copper market, while the resultant increasing demand has been met by a steady increase of supply—both measured by the production curve. Meantime the wages paid have been increasing as steadily throughout the period observed.

Prices are made in the general market and indicate the progress of the average of all mines in reduction of costs; for the market price, in all open business, is costs plus, in the long run, a fair business profit. Costs are determined by the conditions of the particular case, the progress of improvements and the influence of new inventions and discoveries. If the costs are not so far below the market price as to permit a fair profit to be in the long run made, the business languishes or expires. If the profits are abnormally large, more capital at once goes into production and reduces the excess by increasing supply, widening the market at a lower price.

During the past generation, and particularly the twenty years preceding the com-

trol substantially all economic phenomena, and determine costs, which in turn determine the demand, and the demand now always meets the supply at a price which gives fair business returns on capital.

R. H. Thurston.

IN MEMORIAM: JOHN GREGORY BOURKE.

In 1892 the country was startled by the announcement in the papers that Captain John Gregory Bourke, of the Third Cavalry, United States Army, had been assassinated in broad day and in a thronged court-room in Texas, by some friends of the bandit Garza, against whom the Captain was testifying and whose forces he had defeated on the Rio Grande frontier. The grief and indignation in the army were intense, and many tears were shed by eyes unused to weeping, for there was no man in the military service who had friends more numerous and sincere than those of Captain Bourke. But after some days of mourning, our joy returned on learning that the item in the papers was false, that no coward shot had been fired as reported, and that Captain Bourke still remained a terror to the marauders of the Rio Grande.

Four years passed, and again we were shocked with the sudden and unexpected tidings of his death. But on this occasion the tidings were, alas! true. Now they came from a hospital in his native city of Philadelphia, where, on June 8th, he had succumbed to the sequelæ of a surgical operation performed with a hope of saving his life. At the time it was not generally known that he was ill or stood in need of an operation. Such was the ending of a hero who had a hundred times faced death on the field of battle before the bullet of the civilized foe, and, literally, like the Baron Rudiger, 'Before the Paynim spear.'

Captain Bourke was a soldier by nature and knew no other profession than that of arms. At the early age of 19, while our Civil War was in progress, he volunteered as a private soldier (August, 1862), and served in that capacity until the close of the war. He so distinguished himself in this part of his career that he was appointed to the National Military Academy, upon the recommendation of his illustrious commander, General George H. Thomas, at the close of the war. After the usual course of four years at West Point, he was graduated in June, 1869, and received a commission in the Third Calvalry, with which regiment he remained until the time of his death.

During the seventeen years following his graduation he was doing duty on our Western frontiers, in lonely and isolated garrisons, where so many of our soldiers, in days past, have worn out years of miserable existence, and in active campaigns against hostile Indians.

After five years of work in Washington City, where he was ordered on special duty, connected with his ethnographic researches, he returned again to service with his regiment—not to a dull garrison life, but to the active, warlike service which seemed to be his usual lot. This time he fought, not the the civilized foe or the savage enemy, but the elusive outlaw of the Mexican border. How well he succeded is a matter fresh in the minds of all.

In 1893 he had another brief respite from his military duties, when we all met him in charge of the rare collection in the mimic convent of La Rabida, at the World's Columbian Exposition. When his work there closed he returned to his regiment and assumed command of his troop at Fort Riley, Kansas. But he had not rested long until he was called again to Chicago, but by a sterner duty than that which called him there before. He came to quell the rioters of 1894 and to protect the United States mails. He discharged his difficult duties on this occasion, as usual, with credit to himself and profit to his country.

At length, after its long and arduous service in the far West, the valiant regiment to which he belonged was given the merited reward of a pleasant and peaceful station in the East. It came to the newly constructed post of Fort Ethan Allen, on the shores of Lake Champlain. Here we hoped our friend might long remain to enjoy his well-earned repose before he went on another campaign, but here it was destined that his earthly campaigns should end forever.

"A courageous man," says Webster, "is ready for battle, a brave man courts it, a gallant man dashes into the midst of the conflict." To the class of gallant men, Captain Bourke distinctly belonged, and he represented the highest type of the American soldier. In his boyhood he won a medal of honor—that decoration of the Republic which none but the bravest may wear—for gallantry in the memorable battle of Stone River, in Tennessee. For gallantry during Indian campaigns he was tendered two brevet commissions, that of captain and that of major, but both of these he modestly declined.

Some idea of the fierce battles which he fought on the frontier may be gleaned from his writings; but in these, while fullest justice is done to the bravery of his comrades, his own heroic part is modestly suppressed. It is enough to say that, for years, he served on the staff of that distinguished warrior, General George Crook, for none who had not 'A frame of adamant, a soul of fire' found favor in his eyes or could long follow the severe labors which he demanded of his soldiers.

So much for the military career of our subject, over which we would gladly linger, but which we must dismiss with brief words, and proceed to consider his claims on our attention as an ethnologist—the claims which most interest the members of this meeting.

Like a true soldier, he honored a brave foe. If the Indian found him a deadly enemy in time of war, he found also a true friend and advocate in time of peace. At an early time in his career he became interested in the customs and languages of the Indians and began to note these. He gained the confidence and respect of Indian allies and was afforded rare opportunities for investigation. The notes made from his original observations form the basis of most of his works; but he found means also for enriching his fund of knowledge by means of comparative studies.

In 1886 he was ordered to Washington to compile his ethnographic notes. He remained at the Capital about five years, and during this period spent most of his time in the great libraries reading the works of early explorers and ethnographers and makings copious notes. How well he collated and how wisely he compared is evinced by his excellent works on the 'Medicine-men of the Apaches' and the 'Scatalogic Rites of all Nations.' Had he lived longer we have no doubt he would have drawn further from his ample store of notes.

Of his published contributions to ethnography, which were numerous, perhaps the most noteworthy was his 'Snake Dance of the Moquis of Arizona.' In this he set an early example to students in the too long neglected study of ceremony and showed how minute and careful the observations of ceremonials might be made. The existence of this wonderful rite was known to few when he first witnessed it, but his work spread the fame of the Mokis and their ophiolatry over the world. To-day the biennial rite attracts visitors from every quarter, and the high pueblo walls that overhang the sacred rock are thronged with hundreds of white faces, mingled with the dusky ones that look down upon the awful rite below. His work stimulated the

efforts of other investigators. Many scholars have, since his book was written, made the long pilgrimage to the desert mesa to witness the ceremony, and some have spent years in studying the rite without yet learning all that there is to be known.

In 1895 Captain Bourke received two well earned tokens of the recognition of his work. He was elected Secretary of the Section of Anthropology of the American Association for the Advancement of Science and President of the American Folk-Lore Society.

As a writer, Captain Bourke displayed great power. In his scientific treatises he was clear and concise; in his popular works, entertaining, witty, and, to a high degree, graphic. His pictures of early days in Arizona and of wild life on the Western frontier have, in their way, not been excelled; while some of his descriptions of Indian campaigns and battles stand unrivalled in the literature of modern warfare.

Captain Bourke was only 53 years of age when he died—an age when men are often in the fullest exercise of their intellectual powers. Only a few months before his death he told the writer, in a letter, that he hoped soon to get retired from active duty, on account of length of service; to make Washington his home and to devote the remainder of his life to the study of American Ethnology. What a hope was here held out for Science! What a pleasant anticipation to the writer, who looked forward to frequent association, in congenial pursuits, with his valued friend! "Oh Death! Where is thy sting?" It is here. In our hearts we feel it. It will abide with us forever.

Our loss is irreparable. Some say that the loss of no man is irreparable and that where one falls, another as good takes his place; but with our subject such is not the case. The life he experienced, the scenes he witnessed, many of the customs which he had studied and had not described to the world are part of an irrevocable past. The 'sea of change' sweeps as a tidal wave over all that belongs to our aborigines. Many reminiscences stored in his memory are buried with him.

But while the world of science may mourn in its formal way, it is to the intimate friends of Captain Bourke that his loss is deeply painful. He was a man of the most charming personality. In his serious moods his conversation was wise and instructive, while, for his gayer moments, his wide experience and close observation had given him an inexhaustible fund of narrative. He was an excellent mimic and always told his story to the best advantage. He was not only a humorist, but a decided wit, and he had the rare faculty, when uttering his wittiest sayings, of assuming a sad expression of face which might put to shame 'The Knight of the Sorrowful Countenance.'

A gallant soldier, a chivalrous gentleman, a scholar of rare acumen, a faithful friend, a dutiful son, a loving husband, a devoted father; such was the comrade over whose grave the bugle has sounded 'taps' on the Heights of Arlington.

Washington Matthews.

THE BOTANICAL SEMINAR OF THE UNIVERSITY OF NEBRASKA.

The Botanical Seminar of the University of Nebraska celebrated its decennial on October 10th. The Seminar was founded on October 11, 1886, as a quasi-fraternal organization of seven students in the botanical department. It soon grew into a serious botanical society, and since 1888 has been maintained as such by graduate students in botany in the University. It is a unique example of a society without constitution, by-laws, or written rules of any sort. No election has ever been held, no motion has ever been made and no formal vote has

ever been had upon any subject at its meetings. But the society has developed a traditional constitution of some complexity that is closely followed. Although it now exists solely as a scientific society connected with the botanical department of the University, many traces of its original character remain, such as the seal, the designations of the officers and the method of determining them, certain ceremonies of initiation, etc.

The decennial exercises were begun by a public meeting in the afternoon. At this meeting, announcements were made of five public meetings for the reading of papers to be held during the year, and two 'symposia,' or oral discussions of certain subjects under the leadership of one member. It was also announced that Dr. William Trelease would deliver the annual address before the Seminar in May next. Prof. Bessey read a paper entitled 'The Evolution of a Botanical Journal,' which is published in the *American Naturalist* for December. Mr. Clements read a paper on 'The Plant-formation as an Element.' Mr. Pound read a 'Report on the Work of the Seminar 1886–1896.' The following items are taken from this report:

The Seminar maintains four grades of membership, two for graduates and two for undergraduates, known as socii, ordinarii, novitii and candidati. Since the reorganization of the Seminar, all but socii have been required to submit to an oral and a written examination for each grade by examiners appointed by the Seminar. Fourteen examinations have been held and seven members have been admitted under this system. The subjects examined upon have been Anatomy and Morphology of Anthophyta and Pteridophyta, Physiology, Morphology and Development of the Lower Plants, Embryology of the Anthophyta, Taxonomy, Bibliography, History of Botany, Nomenclature, the Flora of Nebraska and Spencer's Principles of Biology. Twenty members have taken part in the work of the Seminar since its organization, of whom eight are now resident. Two students are now preparing for examination.

Since 1888 forty-five meetings have been held for reading papers, at which one hundred and fifteen papers have been read. About twenty-five of these have been published in various scientific periodicals. The titles of the papers read show great improvement since the Seminar began to hold such meetings. Among the title of papers read the first year are: 'The present Status of the Algo-Lichen Hypothesis,' 'History of the Classification on Fungi,' 'Buchloë and its Relatives,' 'The Homologies of the Uredineae.' In 1894–95 some titles are: 'Some Observations on Transpiration,' 'Sketch of a Revision of the Mucoraceæ,' 'The Derivatives of the Apical Cell in Beta vulgaris,' 'Recent Discoveries as to Cell-division.' In 1895–96 among the papers read are: 'The Phytogeography of the Little Blue Valley,' 'The Muciferous Canals in the Laminariaceæ,' 'The Position of the Ovule in Ranunculus.'

In 1895 the custom of an annual address by a botanist of note was established. Dr. Coulter delivered the first of the series. Professor MacMillan followed in May, 1896, and in May, 1897, Dr. Trelease will deliver the address. In addition, short talks have been made to the Seminar by Dr. Coulter, Dr. Burrill, Professor A. S. Hitchcock and Professor MacMillan.

In 1892 the Seminar undertook the Botanical Survey of Nebraska. When Dr. Bessey came to Nebraska, in 1884, no proper work had been done upon the flora of the State. An extensive and pretentious catalogue and several pretentious lists had been put out, but they were based on conjecture as to what should be in the State rather than on observation and collection, and were entirely unreliable. In 1886 the members of

the Seminar began to take up the work of investigating the flora of the State, and in 1890 Mr. Webber, one of the original members, put forth a catalogue enumerating 1890 species. The next year he published an appendix containing 432 additions chiefly made by members of the Seminar, and, hard on the heels of this appendix, Dr. Bessey issued a supplement raising the number of reported species to 2492. To keep up this work and to give it system, the Survey was organized. This Survey is conducted and directed by the Seminar and is maintained entirely by the individual members without public assistance of any sort. Its fruits are four reports in which the reported flora of Nebraska is raised to 3196 species, a herbarium of 7500 specimens representing the flora of the State, and five important expeditions which have made possible an exact phytogeographical districting of the State. In consequence, Nebraska has come to be recognized as one of the best known States botanically in the country. The Seminar now has in preparation an elaborate report on the phytogeography of the State for which it has been gathering materials for many years.

A more ambitious undertaking has been the publication of the Flora of Nebraska, of which three parts have now been issued and two more are under way. The Flora has been fairly successful financially, and in other respects its success is unquestioned. In addition to the Flora and the Reports of the Survey, the Seminar has published two addresses delivered before it.

Of the eleven who have taken part in the work of the Seminar as ordinarii, four are now employed in the United States Department of Agriculture, namely, Mr. Smith, Mr. Webber, Mr. Williams and Mr. Woods; another is professor of Botany in a State Agricultural College, and another holds the botanical fellowship at Columbia University. All of them have become known through their published work, and they are all busily engaged upon other publications of importance.

At the close of the public meeting, Mr. Ernst A. Bessey was initiated as a novitius, having taken the required examinations. Letters were next read from absent members and friends of the Seminar and also letters which had been received from botanists and scientific men. Thereafter a 'symposium' was held, led by Dr. Bessey, upon the subject of the Laboratory Method. By way of introduction, Dr. Bessey spoke of the history and the development of botanical laboratories in the United States, and the present differentiation into histological and physiological laboratories. The future of botanical laboratories was then discussed, Dr. Bessey, Dr. Ward, Professor Bruner, Mr. Pound and Mr. Clements taking principal parts in the discussion.

In the evening, Dr. H. B. Ward delivered the anniversary discourse, before the Seminar and invited guests. His subject was 'Tendencies in Biological Investigation.' It would not be possible to do justice to the discourse by such a synopsis as could be given here.

At the close of the discourse the Seminar and its guests sat down to a collation served in the histological laboratory, which had been suitably fitted up for the occasion. Mr. Roscoe Pound, who acted as toastmaster, spoke for the 'Original Seven,' the founders of the Seminar. Mr. Clements responded for the 'Epigoni.' Professor Bruner responded to 'Canis Pie,' the emblem of the Society, and explained its appropriateness. Dr. H. K. Wolfe, in speaking on 'Philosophia Botanica,' said that the history of botany differed from that of most other sciences in that its progress had been uninterrupted by convulsions or catastrophes and it had kept moving. He had wondered if this might be due to the fact that Aristotle's work on plants was lost, so that the grasp

of antiquity was less strong than elsewhere. "In spite of this constant growth," he continued, "there have appeared few great generalizations in botany, and so it is not absolutely correct to speak either of a botanical philosophy or of a philosophical botany. In common with all branches of biological science, botany must rest content with details and small excursions into neighboring fields of common interests. This is the fate of all modern investigation."

Dr. Bessey responded to 'How I manage the Boys.' He said that the fact was the boys managed him. He was like the prudent driver of a team, who, when he saw it was about to stop, pulled the reins and cried 'whoa,' or like the man who 'manages' his household, or like the meteorologist who manages the weather. As to the relation of the Seminar to his department, he said it must be remembered that the Seminar had grown up as an independent society and was not a part of the department. It was an ally—a close friend. Its help was like the help that a good wife is to a man, and the same kind of 'management' existed in each case. He had always adhered to Joseph Henry's rule; he let the boys work, and let them take up any line they would without restraint.

Responses were made by Dean Sherman, of the chair of English literature, who commented favorably upon the fraternization of scientific savants and literary scholars, who aforetime were too much inclined to fall upon each other by the way, and by the Chancellor of the University, who saw in the present occasion the beginning of a closer union of the workers in the different fields of science in the University, as well as the promise of higher and broader work such as should be found among scholars; "the work of the Seminar is true university work, and the spirit it fosters is that which is the peculiar feature of the genuine university."

*FOURTEENTH ANNUAL REPORT OF THE COMMITTEE ON INDEXING CHEMICAL LITERATURE.**

THE Committee on Indexing Chemical Literature presents to the Chemical Section its fourteenth annual report. During the year ending August, 1896, there has been exhibited much activity in chemical bibliography and indexing; several valuable works have been completed and many important undertakings have been begun.

WORKS PUBLISHED.

A Dictionary of Chemical Solubilities. Inorganic. By ARTHUR MESSINGER COMEY. New York and London. 1896. pp. xx+515. 8vo.

Prof. Comey is to be complimented on the completion of the first part of his extensive undertaking, and chemists are to be congratulated on the publication in such good form of so important an aid to research. It is to be hoped that this volume will be so well received as to encourage the author to follow promptly with the organic section.

Index to the Literature of the Detection and Estimation of Fusel Oil in Spirits, by W. D. BIGELOW. *J. Amer. Chem. Soc.*, Vol. xviii., No. 4, p. 397.

This was announced in our report for 1895.

Bibliography of Embalming, in a Thesis entitled: 'Embalming and Embalming Fluids,' by CHARLES W. MCCURDY (of the University of Idaho). *Post-graduate and Wooster Quarterly*, April, 1896.

A very full bibliography of this unique subject, which has its chemical aspects as well as its grave ones. It comprises about 500 entries, in several modern languages, arranged alphabetically by authors.

* Presented at the Buffalo Meeting of the American Association for the Advancement of Science.

References to Capillarity, by JOHN URI LLOYD, in his 'Study in Pharmacy.' Privately Printed. Cincinnati, 1895–96. 8vo.

Atomic Weights form the subject of a brief bibliography (24 titles) accompanying an article on the same topic by ALEXANDER SCOTT. *Science Progress* Vol. I., p. 542 (August, 1894).

The Composition of Water, a short bibliography, by T. C. WARRINGTON. *Chem. News*, Vol. lxxiii., p. 137 *et seq.* (March, 1896.)

A Short List of Books on Chemistry. Selected and annotated by H. CARRINGTON BOLTON, *Scientific American Supplement*, October 19, 1895.

Bibliography as a feature of the Chemical Curriculum. By H. CARRINGTON BOLTON. SCIENCE, October 4, 1895.

Review of American Chemical Research, edited by ARTHUR A. NOYES. In the *Technology Quarterly*, issued by the Massachusetts Institute of Technology, Boston, Mass.

The first paper appeared in the number for April, 1895 (Vol. viii., p. 90); the reviews consist of abstracts of papers in periodicals, grouped under the following heads: General and Physical Chemistry, Inorganic, Organic, Technical, Sanitary, Agricultural, Vegetable, Metallurgical, Assaying, Geological, Mineralogical, Apparatus. Each abstract is signed by the abstractor.

This review promises to be an important contribution to contemporary chemical science of America, and deserves to be well supported.

Enumeration of Titles of Chemical Papers. This bibliography has been published monthly since May, 1894, in *Science Progress*, London. It embraces titles (without comments) in several European languages.

Bibliography of Agricultural Chemistry (American).

The several publications of the scientific bureaus of the United States government contain many valuable contributions to chemistry in its applications to agriculture and the arts, widely scattered in their pages, and it has been difficult to keep informed with reference to them. Thanks, however, to the excellent bibliographical work of the Office of Experiment Stations, U. S. Department of Agriculture, Washington, D. C., the chemical treatises published in the Bulletins of the State Institutions are made accessible; this is accomplished in the three publications here named:

Experiment Station Record, Vol. iii., No. 12 (July, 1892). *Bulletin* No. 19 (1894), and *Bulletin* No. 23 (1895). Organization Lists of the Agricultural Experiment Stations, U. S. Department of Agriculture, Office of Experiment Stations.

These contain: 'Lists of Station Publications,' giving dates, bulletin numbers and titles of each bulletin, under each State, alphabetically arranged. For the agricultural chemist these bibliographical helps are too important to be overlooked.

The Committee also chronicles the publication of the following valuable aids to chemical research:

Synopsis of Current Electrical Literature during 1895, by MAX OSTERBERG. New York (D. van Nostrand Co.), 1896. pp. xiii+143. 8vo.

This is a classified index, with an index to authors, compiled from fifty-nine foreign and American periodicals; it is intended to be published annually.

General-Register zu Ladenburg's Handwörterbuch der Chemie. Breslau, 1895. pp. 160. 8vo.

Bibliographie des travaux scientifiques * * * publiés par les sociétés savantes de la France, dressée sous les auspices du ministère de l'instruction publique; par J. Deniker. Paris, 1895. 4to.

REPORTS OF PROGRESS.

The Index to the Mineral Waters of the World, by Dr. Alfred Tuckerman, noticed in previous reports, has been completed and accepted for publication by the Smithsonian Institution.

The manuscript of a new edition of the 'Catalogue of Scientific and Technical Periodicals, 1665–1882,' by Dr. H. Carrington Bolton, has been completed and is now going through the press. The new edition will be issued by the Smithsonian Institution as a volume of the Miscellaneous Collections. The bibliography includes chemical journals, and is brought down to the year 1895.

Dr. Bolton reports progress on a supplement to his 'Select Bibliography of Chemistry, 1492–1892,' the printing of which is, however, postponed.

Prof. James Lewis Howe reports the completion of the manuscript of an Index to the Literature of Platinum and its Compounds; this will be presented to the Chemical Section at the same session with this report.

Prof. F. P. Venable has completed an Index to the Literature of the Periodic Law. It accompanies his 'Development of the Periodic Law,' published by the Chemical Publishing Co., Easton, Pa.

WORKS IN PREPARATION.

Dr. Alexis A. Julien has no less than three bibliographical works well advanced:

(1) A Bibliography of Sand (including chemical analysis, etc.).

(2) A Bibliography of Pedesis, or the Brownian movement.

(3) A Bibliography of the Condensation of Gases on the surface of Solids.

Dr. Arthur C. Langmuir is engaged on an Index to the Literature of Zirconium.

Mr. George Wagner, of the University of Kansas, has undertaken an Index to the Literature of Oxygen, on a large scale. In this work he will have the counsel of Prof. Albert B. Prescott.

Dr. C. H. Joüet has the manuscript of an Index to the Literature of Thorium well advanced towards completion.

Prof. Rudolph A. Witthaus has compiled a Bibliography of Forensic Toxicology, which will appear in Vol. iv. of Witthaus and Becker's Medical Jurisprudence, New York, 1896.

The Journal of the Society of Chemical Industry announces a Collective Index for the whole series, 1881–1895. This is to be ready in 1896 and will form a volume of about 500 pages quarto.

Attention is called to a plan for facilitating bibliographical researches, adopted by the American Pharmaceutical Association. The Research Committee of this Association employs a reference reader whose duty it is to supply original literature to investigators working in the Committee and with it. A list of the chief serials and a few encyclopedic works are placed in the hands of those who apply for the services of the reader. Transcripts, abstracts and translations are supplied. The service is chiefly for literature beyond the smaller libraries, and is under the direction of the Chairman of the Committee.

Perhaps a similar scheme might be organized within the American Association for the Advancement of Science.

In conclusion, the Committee on Indexing Chemical Literature desires to state to those not acquainted with the announcements made in the preceding annual reports, that it labors to foster individual undertakings in chemical bibliography, to prevent futile duplication of work, to record in these reports completed bibliographies and new enterprises, as well as to chronicle progress in bibliography in lines bordering on chemistry. Suggestions as to topics, methods, channels of publication, etc., will be cordially furnished by the Committee. Ad-

dress correspondence to the Chairman, at Cosmos Club, Washington, D. C.

H. Carrington Bolton, *Chairman*,
F. W. Clarke,
A. R. Leeds,
A. B. Prescott,
Alfred Tuckerman,
H. W. Wiley, *Committee.*

CURRENT NOTES ON PHYSIOGRAPHY.

PACIFIC OCEAN CURRENTS.

Dr. Cäsar Puls contributes an elaborate discussion, based on original records, of the surface temperatures and currents in the equatorial belt of the Pacific Ocean to the 'Archiv der Deutschen Seewarte' (Hamburg, XVIII., 1895, 1–38, with 12 monthly charts). The chief interest attaches to the equatorial counter current, which maintains its eastward course all across the ocean between the wind-driven, west-flowing equatorial currents on the north and south, the latter being much the stronger of these two. The north equatorial current, from 9° to 20° N., is strongest in March; it is not altogether supplied at its east end by the weak southward current along our west coast; it receives much water from the counter current which turns northwest at its east end, and not southeast, as ordinarily mapped. At the west end of the north equatorial current, part turns north to flow past Japan, and a lesser part south to join the counter current. The great south equatorial current, from 12° S. to 5° N., is strongest in September, and has its highest velocity along its northern margin, sometimes over 100 nautical miles in 24 hours. It is largely supplied by up-welling water along the west coast of South America, where the wind blows off-shore; the Humboldt surface current is not sufficient to feed it. Part of this great equatorial current turns south before reaching the Solomon Islands; the rest passes on north of New Guinea and turns sharply back at the 'root' of the counter current, except from December to May, when this branch is turned back on itself by the northwest monsoon then and there prevalent, forming a short counter current south of the equator. The north counter current, extending all across the ocean, is said to be much influenced, but not produced, by the winds. Near its west end it is favored for three-quarters of the year by the southwest monsoon; and from July to October, when it is, as a whole, strongest and broadest, its east half is favored by the narrow belt of monsoon winds there and then occurring. It is narrowed and weakened in our winter, when these favoring winds are wanting, and from January to March, under the extended northeast trade, it may be stopped or locally reversed; but where and whenever these adverse winds weaken or shift, the current reappears, and sometimes with increased strength. Yet, as a whole, it is regarded as a compensation current, discharging eastward the excess of the wind-driven south equatorial current, which has no sufficient escape at its west end.

If a narrow current, 8,000 miles long, can be a compensation current, a previous note on this subject in Science (III., 1896, 921) should be somewhat modified. It may be added that according to these descriptions the Pacific counter current serves indirectly to carry water continually from the southern into the northern hemisphere, receiving a supply from the south at its west end, and discharging its flow chiefly northward at its east end; thus doing what is more directly accomplished in the Atlantic by the cross-equator extension of the south equatorial current past the Guiana coast. In the Pacific, as in the Atlantic, a compensation for this excess of surface movement into the northern hemisphere must exist beneath the surface, and with fuller data as to deep temperatures this may aid in deciding the cause of the

deep oceanic circulation. (See SCIENCE III., 185, 824.)

THE EAST AND WEST INDIES.

PROF. K. MARTIN, of Leyden, discusses the origin of the above-named region (Zur Frage nach der Enstehung des ost- und westindischen Archipels. Hettner's Geogr. Zeitschr., II., 1896, 361–378). His style of treatment is elementary and somewhat incomplete, and his method does not reach far into the past. Sea cliffs cut in elevated coral reefs are described at three levels on Curaçao, where the successive steps seem to be of artificial regularity. As the cliffed reef rings around the island with small interruption, it is regarded as an uplifted atoll. Other examples are given. In the East Indies, on Saparua, east of Amboina, eleven terraces are found in elevated reefs; on Buton, southeast of Celebes, nine. The coastal plain of Dutch and British Guiana slopes gently northward; here reefs are wanting, as the shallow impure water was unfit for coral growth; but former shore lines are distinctly marked by elevated beaches, largely composed of shells, like the existing beach walls. Fourteen of these have been counted, Paramaribo being on one of them. Elevated coral reefs are again wanting on the larger East Indian islands, but their marginal plains contain plentiful marine shells of recent species; these being well preserved about Batavia. Additional facts are mentioned, but they hardly cover the wide areas considered. It is concluded that at a recent date the configuration of the shore lines was very unlike that of to-day, and that an extensive elevation has been in progress.

THE RIVER ETSCH.

PENCK gives an account of Etsch, flowing southward through the Tyrol to the Italian plain, where it is known as the Adige (Zeitschr. Deutsch. u. Oesterr. Alpenvereins, XXVI., 1895, 1–15). The river lies somewhat to the east of the axis of a Tertiary trough that is included between the Adamello Mountain group on the west and the dissected Dolomite plateau on the east. Below its torrential headwaters, rock is not exposed in the aggraded valley floor. Lateral streams bring in much detritus, forming fans at their mouths and driving the main stream against the opposite valley wall. Up stream from each fan the slope is moderate, and the flood plain is sometimes swampy; but immediately down stream from the fans the descent is rapid. No cause is assigned for the clogging of the rock-cut valley. The narrow gorge through which the river emerges upon the plain is here, as commonly elsewhere, a result of morainic displacement from the preglacial valley. The valley is slightly incised beneath the general level of the plain for about a third of the way to the mouth; but on reaching the level where the ground water of the plain emerges in numerous springs (fontanili) the river becomes an aggrading stream and rises above its surroundings, so as to need diking. In this lower part of its course it is turned aside from the Po, whose aggrading action is more powerful, and for this reason the Adige pursues an independent course to the Adriatic.

HARVARD UNIVERSITY. W. M. DAVIS.

CURRENT NOTES ON METEOROLOGY.

CLIMATIC CONTROL OF CIVILIZATION IN AFRICA.

THE influence of climate on civilization in Africa was brought out by Scott Elliot before the Geographical Section of the British Association at Liverpool. Africa may be divided into four regions: (1) the wet jungle, characterized by great heat and continuous humidity; (2) the deserts, with no proper rainy season; (3) the acacia and dry grass region, with distinct dry and wet seasons, and (4) the temperate grass and forest region, with moderate rainfall, mod-

derate heat and no season so dry as to leave a permanent mark on the vegetation. As regards the characteristics of the people who inhabit these different regions, it seems that the wet jungle is the home of small weak tribes in the lowest stage of civilization. Healthy and vigorous tribes, on the other hand, inhabit the desert. The acacia region is rather densely populated everywhere, but no large emigrations have taken place from it. The temperate grass and forest regions are inhabited by vigorous and turbulent native tribes, who have, except in one instance, resisted both the Arab and the European.

ECLIPSE OBSERVATIONS.

METEOROLOGICAL observations made in Russia during the solar eclipse of August 9th are at hand (Met. Zeitschr., October, 1896, 399–400). At the Central Physical Observatory, in St. Petersburg, in spite of the low altitude of the sun, the dull weather and the light rain, a fall in the temperature of the air and of the earth's surface was noticeable. At the beginning of the eclipse (4:51 a. m.) the air temperature was 55.4°; at 5:45, 55.2°, and at the end of the eclipse (6:43 a. m.), 55.7°. The temperature of the earth's surface fell more decidedly. At Pawlowsk, where the sky was also covered with clouds almost all the time, and light rain was falling, the air temperature at the beginning of the eclipse was 56.6° ; at the middle, 56.1°. A Sprung barograph showed a sudden fall of .25 mm. before the beginning of the eclipse, while during the eclipse there was a rise of .75 mm., and after it a fall. Such rises of pressure have been previously observed during solar eclipses, and are probably due to the decrease in temperature caused by the cutting off of the sun's rays and the resulting in-creeping of the air above.

EARLY MEASUREMENTS OF CLOUD HEIGHTS.

THE October number of the *Meteorologische Zeitschrift* contains a note on the earliest measurements of cloud heights of which there is record. It appears that two Jesuits, Ricciolo and Grimaldi, made some trigonometrical measurements of the heights of clouds in 1644 near Bologna. Riccioli, in his work, 'Almagestum novum,' collected the previous writings on the subject and proposed a scheme for calculating the heights of clouds by observations of their shadows. The luminous night clouds, about which there has been some discussion within the past few years, were observed by Maignan, and explained by him, in 1648, as being illuminated by the sun, they floating at so great a height as to be outside of the earth's shadow.

THE TORNADO OF SEPTEMBER 10TH IN PARIS.

AN account of the Paris tornado of September 10th., last, appears in *L'Aerophile* for October, together with diagrams showing the curves traced by the self-recording instruments at the Tour St. Jacques Observatory. The barograph curve indicates a sudden fall of 6 mm., an immediate recovery to a slightly higher (.25 mm.) pressure than was recorded just before the fall; then a slight fall of .50 mm., followed by a gradual rise. The air temperature at the top of the tower rose at the time of lowest pressure, rather suddenly, and then fell. The hygrometer indicated decreasing humidity for some time before as well as during the time of minimum pressure. The data as to the destruction caused by, and the general characteristics of, the phenomenon point to its having been a true tornado, though not by any means a violent one.

NOTES.

The Hot Winds of Northern India and *An Account of a Storm Developed in Equatorial Regions* are the subjects of two recent papers by Eliot and Dallas respectively, in Vol. VI., Part III., of the Indian Meteorological Memoirs.

R. C. MOSSMAN: *The Meteorology of Edinburgh.* Transactions Roy. Soc. Edinb., Vol. XXXVIII., Part III., No. 20, 1896. Contains the reductions of observations made in Edinburgh during the past 132 years, with colored plates illustrating some of the principal features of the climatology of the city.

TH. ARENDT: *Die Bestimmung des Wasserdampfgehaltes der Atmosphäre auf Grund spektroskopischer Messungen.* Met. Zeitschr., Oct., 1896, 376–390. The results of an investigation carried on at the Potsdam Observatory during 1895 and 1896.

R. DEC. WARD.

HARVARD UNIVERSITY.

CURRENT NOTES ON ANTHROPOLOGY.

ARAUCANIAN STUDIES.

THE excellent studies of Dr. Rudolfo Lenz in modern Araucanian have already been mentioned in these notes. A new instalment of them includes dialogues in the Pechuenche dialect, some small original pieces in the Picunche and Huilliche dialects (Spanish and Araucanian) and a collection (72 pages) of Araucanian tales and stories published in German in Valparaiso. The latter are divided into mythological tales, animal stories, others of European origin and some songs. They are interesting examples of the present condition of folk-lore among these intelligent natives.

No other investigations into the language of the aborigines of Chili equal in method and accuracy these of Dr. Lenz. They are, in fact, models of their kind.

The language itself is one of beauty and strength. Indeed, in the last century the missionary Haverstadt was so impressed with its resources that in 1777 he published a work upon it ('Chilidugu') in advocacy of its adoption as an universal tongue for the world, a ready-made Volapuk.

The publication of Dr. Lenz can be obtained through Karl M. Hiersemann, Königsplatz 2, Leipzig, Germany.

RACE DEGENERATION IN THE SOUTHERN STATES.

AN unusually thoughtful article appears in the Bulletin of the American Academy of Medicine (Vol. II., No. 9), by Dr. John T. Searcy, superintendent of the insane asylum at Tuscaloosa, Ala. The subject treated is insanity in the South, and its relations to race were brought out prominently. Some of these may be noted.

The native American (white) when insane is more adaptable to his environment than any other stock. The American Indian is just the opposite—not at all adaptable to new conditions. Insanity is a symptom of a race-degenerating process. It is more observable in negroes since the Civil War,as, compared to the condition of slavery, "degeneracy is increasing in the majority of the negroes." The whites are less so, because "during the time of slavery brain idleness and brain injury prevailed to a greater extent among the whites than at present." Compared with his previous condition in Africa, the negro was much better off as a slave in America than he ever was before. This general improvement in his condition showed itself in the absence of mental degeneracy. His present types of insanity 'show the same race traits in the hospital which they do on the outside.' That is, they are more emotional, and yet his delusions are weaker and more transient.

D. G. BRINTON.

UNIVERSITY OF PENNSYLVANIA.

NOTES ON INORGANIC CHEMISTRY.

IN the last Chemical News Prof. Brauner, of the University of Prague, discusses the theory that argon is a polymer of nitrogen, N_3, and helium a polymer of hydrogen, H_4, or more probably a mixture of H_3 and H_5. His argument is directed almost solely against the elementary nature of argon and helium and the arguments which have been put forward to show that argon is not N_3.

Against the elementary nature of argon and helium stands the difficulty of placing them in the periodic system. He does not agree that the argument drawn from the ratios of the specific heats is conclusive as to the molecule of argon or helium containing only a single atom. The density of argon, 19.94, being less than that of N_2, 21.06, he accounts for by the possibility of the presence of helium or some other inert gas. Of positive arguments in favor of his theory he gives none, but suggests that a determination of the atomic heat would decide the question. He inclines to the view that the constituents of helium were formed from hydrogen in accordance with Prout's law.

The latest contribution to a systematic arrangement of the elements is an article by Richard Lorenz in the Zeit. Anorganische Chemie, on 'Twin Elements.' The author gives this name to elements which have nearly the same atomic weight, resemble each other in occurrence and chemical behavior, and are with difficulty separated from each other. Such twins are sodium-magnesium, cobalt-nickel, phosphorus-sulfur. The atomic weights of each twin differ from those of the next twin by four units. In some instances a single member only of the pair exists or is known, as chlorin is the only element of the twin which lies between phosphorus-sulfur and potassium-calcium. Lorenz develops from this a germinal rule. Taking as his starting point the atomic weights three and four, the latter corresponding to helium, he proceeds by successive increments of four. Of the second pair (7, 8), lithium only is known; the third twin is (11, 12) boron-carbon; of the fourth only oxygen is known; of the fifth (19, 20), we have fluorin, and perhaps argon. Up to the atomic weight of 128, thirty-nine elements correspond to this germinal rule, while there are ten elements whose weights do not fall within the limits of any pair. Fourteen of the thirty-two twins have but one member, four twins have no known member, and one twin, cobalt-nickel, is displaced one unit from its theoretical value. Of the elements of higher atomic weight, ten of the best known follow the rule, while four do not. The author seems to indicate his opinion that this germinal rule expresses the composite nature of the elements, and suggests that the elements which conform to it may be built up analogous to one series of hydrocarbons, while the exceptions may be built up on a different plan.

The article recalls two anonymous contributions to the American Supplement to the *Chemical News* for 1869 (pp. 217 and 339) on the 'Numerical Relations of the Atoms' and the 'Pairing of the Elements,' where very similar ideas were suggested.

J. L. H.

ASTRONOMICAL NOTES.

In our issue of November 15th we called attention to an article by Dr. Marcuse, of Berlin, giving an account of a series of observations made by him with the new photographic zenith telescope belonging to the Geodetic Commission. We have now received Prof. Albrecht's report upon the performance of the same instrument, which has been mounted at Potsdam side by side with the old visual instrument. This arrangement has enabled Herr Schnauder and Dr. Hecker to carry out a simultaneous series of observations with the two instruments, and using the same stars. The result of the research was not favorable to the photographic instrument, since it necessitated much extra labor, without any sufficient compensating advantage in the accuracy attained. It will be remembered that the Geodetic Commission proposes to establish four permanent observing stations on the same parallel of latitude, but differing nearly 90° in longitude, in order to get a continuous and very accurate determina-

tion of the latitude variations. The present tests of the new photographic instrument were undertaken with a view to the employment of such instruments at the four proposed stations. The results obtained at Potsdam will, therefore, cause the adoption of the older form of instrument.

PROF. ALBRECHT has published his 1896 report on the variation of latitude. He has included all series of observations from 1890.0 to 1896.5 and, after plotting them, has drawn a curve through the points obtained. This furnishes the means of getting the instantaneous latitude for any place on the earth, and for any time between the extreme dates used in the formation of the curve. This is probably the best way of treating the question, so far as the reduction of recent meridian observations is concerned, but it is useless for purposes of prediction, or for the re-reduction of older series of observations. But perhaps the time has not yet come for a definitive attempt to obtain laws for the motion of the pole which will permit accurate prediction, or which will represent former motions of the pole with entirely satisfactory precision. H. J.

SCIENTIFIC NOTES AND NEWS.

GEOLOGICAL FIELD WORK OF THE UNIVERSITY OF WYOMING.

PROF. WILBUR C. KNIGHT, of the Geological Department of the University of Wyoming, writes that the field work carried on by the department has just closed for the year. The entire season has been spent in studying the Jurassic terrane and collecting its fossils. Besides securing valuable stratigraphical data, many fossils new to science have been discovered. The collection is so large that it will take a year to arrange it for study. The new material can be roughly classified as follows: Invertebrates, six species. Pisces, two species of *Ceratodus*. Plesiosaurs, two species. Ichthyosaurs, one vertebra of a large animal. This must not be confounded with Marsh's *Baptanodon*. Dinosaurs, four species—two carniverous and two herbiverous. Crocodiles, one species.

With this year's discoveries it is now definitely known that there are three species of American Jurassic plesiosaurs, and it is very probable that there are four. This institution has the largest collection of these animals known.

The dinosaurs are very interesting. The largest carnivor is, so far as can be determined at present, a Megalosaur, but not allied to Marsh's *Ceratosaur*. The second carnivor is a very small animal. The two herbiverous animals have not been unpacked. One of them is a very large animal, and the other of medium size. The crocodile is a small species. All of this material has been taken from beds in new localities that have never received any attention.

While collecting new material, parts of most of the saurians that Marsh has described from the Jurassic were found. One of these is probably his Atlantosaurus. The femur in its natural bed measured 6 feet and 3 inches, and a caracoid measured 18×26 inches. Owing to the great additions made this year, the University of Wyoming now claims the second largest collection of American Jurassic vertebrates in the world, Yale having the largest. As soon as this material can be restored it will be described, after which it will be arranged for the students of vertebrate paleontology.

THE BRAIN WEIGHT OF MAMMALS.

AMONG the numerous valuable memoirs in the Gegenbauer *Festschrift* is one by Max Weber, professor of zoology in Amsterdam, entitled 'Preliminary Studies upon the Brain Weight of Mammals.' This contains the most exhaustive and accurate statistics which have been collected hitherto upon the absolute weights of the brain in the mammals and upon the relation of brain weights to body weights. In every case the sex is indicated, also the general condition of the animal. The length of the animal is given, the weight of the body, the weight of the brain, the ratio and the percentage of brain weight to body weight. The conclusions which Prof. Weber draws are thus based upon the most extensive and accurate statistics which have ever been brought together. They are as follows: First, in the matter of absolute brain weight

man is surpassed only by the Proboscidia and Cetacea; with this exception the human brain surpasses that of any other mammal. Second, the relative brain weight of the average European is only surpassed by that of certain smaller animals in which the relative weight is exceptionally high. Third, as to the relation of brain weight to body weight in the comparison of the smaller and larger mammals, it is evident that the brain weight does not increase in proportion to the body weight. Fourth, as a general rule, within any natural order of mammals, the relative brain weight decreases with the increase of the body weight; in other words, within any natural order the smaller mammals have relatively larger brains. But this rule is not without exceptions. In growing individuals the relative brain weight falls off until the maximum of growth is reached. Since the growth of the brain is reached earlier than the growth of the body, this decline is not by any means uniform in different cases. Among the animals which surpass man in the ratio of brain weight to body weight are the following: Among the Rodentia, *Sciurus* and *Mus*, and among the Primates many Old and New World monkeys.

GENERAL.

Benjamin Apthorp Gould, the eminent astronomer, died on the evening of November 26th, at his home in Cambridge. His death was due to the effects of a fall that happened two hours previously. He was born at Boston on September 27, 1824. We hope to give an adequate account of Gould's life and contributions to astronomy.

Plans have been filed for the Botanical Museum to be erected for the New York Botanical Garden in Bronx Park. The building will be of brick and terra cotta, with a frontage of 308 feet. The cost of construction is estimated at $250.000.

At the recent meeting of the *Deutsche Naturforscher und Aertze* arrangements were made for a society of pathological anatomy and physiology.

The Governors of St. George's Hospital, London, of which Jenner was a pupil, propose to inaugurate a national memorial to celebrate the discovery of vaccination. Sir Joseph Lister will preside at a meeting on December 7th, at which the best means of carrying out the project will be discussed.

A committee has been formed in London with a view to publicly recognizing the completion of Mr. Herbert Spencer's *Synthetic Philosophy*. It has been proposed to place a statue in the Museum of Natural History, South Kensington, or a portrait in the national portrait gallery, but it is understood that Mr. Spencer himself does not approve of the plan.

M. Berthelot has collected, under the title *Sciences et Morales*, a number of his articles and addresses treating of the relation of science to society and education. Among these may be mentioned the address before the French Senate on higher education biographical notices of Pasteur, Cl. Bernard and P. Bert, and several articles on the history of the sciences, such as the discovery of alcohol, the survival of ancient industries, the chemistry of the Arabs, pearls, and Papin and the discovery of the steam engine.

We have already announced that the New Research Laboratory of the Royal College of Physicians, Edinburgh, was formally opened on November 6th. Dr. Batty Tuke, in declaring the laboratory open, stated that it was the best equipped in Great Britain. It contains well-equipped laboratories for chemistry, histology and bacteriology, a large experimental room supplied with physiological apparatus, and a photographic room. The laboratory is open to those who are competent to undertake investigation in the medical sciences, and chemicals, etc., are supplied free of charge.

Prof. Windham Dunstan, the new director of the scientific and technical department of the Imperial Institute, London, gave a lecture on November 9th, describing the arrangements and work of the department. It occupies large laboratories, which have been well equipped by the Goldsmiths' Company. The Royal Commissioners of the 1851 Exhibition have provided funds for the payment of the staff, and a research fellowship has been endowed by the Salters' Company. The department proposes especially to investigate the natural products of India and the colonies and to assist in the

utilization of these. It is prepared to answer questions and furnish information on this subject. Investigations are already in progress on the comparative value of Indian coal deposits and iron ores, of Indian and colonial timbers, fibres, dye-stuffs and tanning materials, and especial attention will be given to the study of medicinal plants. The department is intended to become an imperial bureau of scientific and technical investigation and advice.

WE regret to announce the deaths of Dr. Karl Cornelius, docent in physics and meteorology in the University of Halle, and of Dr. Hanot, the French physician, well known for his numerous and important researches in pathology.

A LETTER from Mr. S. A. Thompsom, at Santa Catalin, Venezuela, published in the daily papers, states that in the course of explorations for the Orinoco Company he, with Mr. Leslie O. Dart, discovered in the Imataca Mountains a waterfall that must rank as one of the greatest in the world. A large river falls over an almost perpendicular cliff from a height estimated at 1,600 feet, not, however, in one body, but breaking into many separate streams.

THE American Economic Association will hold its annual meeting in Baltimore from September 28th to 30th. The President, Prof. H. C. Adams, will give an address on the relation of jurisprudence to economics. The organization of the census for 1900 will be especially discussed.

AMONG industrial expositions announced for 1897 is one at Stockholm, at which special attention will be given to machinery and applied science. There will also be expositions at Brussels and Kief, and an electrical and engineering exposition will be held at Newcastle-on-Tyne.

Nature states that it has received a circular announcing the formation of a British Mycological Society, having for its objects the study of mycology in all its branches, systematic, morphological and pathological, the publication of annual reports recording all recent discoveries in any branch of mycology, and more especially giving a brief synopsis of the work of European mycologists and the recent additions to the British Fungus Flora. An annual week's meeting or foray will be held at some place previously determined at the annual meeting. Mr. George Massee, Royal Herbarium, Kew, has been elected first President, and Mr. Carleton Rea, 34 Foregate street, Worcester, is the Secretary. The first meeting of the Society will be held in Sherwood Forest, commencing on the third Monday in September, 1897.

WE announced recently that Prof. Koch was on his way to South Africa in order to investigate the rinderpest. The *British Medical Journal* calls attention to the fact that an elaborate inquiry into the nature, origin, method of treatment and pathological status of this disease was undertaken in 1868 by a Royal Commission in which Sir Richard Quain, Dr. Burdon Sanderson, Lord Playfair and others took an active part. At that time, however, bacteriological science, which has of recent years made such rapid and important progress, was hardly yet in its infancy, and the present methods of investigation, the perfection of which we owe so largely to Dr. Koch himself, did not exist. Elaborate and careful as was the inquiry, it did little more than prove the intense contagiousness of the malady, and the hopelessness of any available method of treatment except by the pole-axe. The policy of stamping out was urgently recommended, together with a system of liberal compensation. These measures had decisive and successful results within their limits, and the epidemic has not since been able to extend itself within these islands. No subsequent information of a scientific or curative kind has since been obtained, and Dr. Koch's investigation into its possible bacterial origin will be awaited with much interest.

THE *British Medical Journal* states that M. Lemoine, of Rheims, has exhibited before the Biological Society the *clichés* of photographs, obtained by Röntgen's rays, of fossils embedded in the chalk strata of Rheims. The Röntgen rays pass imperfectly through phosphates; the bones of the fossils are clearly indicated in all their details. M. Lemoine has thus photographed a series of birds, reptiles and mammals.

In the number of the Transactions of the Academy of Science of St. Louis (Vol. VII., No. 10) issued on November 10th, Mr. J. B. S. Norton contributes a study of the Kansas Ustilagineæ with special reference to their germination. Mr. Norton gives a list of 33 species found in Kansas. These belong to the genera *Ustilago*, *Tilletia*, *Entyloma*, *Sorosporium*, *Urocystis* and *Doassansia*. Germination studies were made on about half this number by means of hanging drop cultures in water and nutriant solutions. Notes on the distribution of the species in the State and the effect on the host plant are recorded. Two new species are described, *Ustilago filifera* on *Bouteloua racemosa* and *B. oligostachya*, and *Ustilago minor* on *Bouteloua hirsuta*. Five plates illustrate the germination and figure the spores and habit of the new species.

The question of telegony must be decided by experiment, and not by casual observations. In the meanwhile, however, it may not be amiss to reproduce the following alleged cases communicated to the *British Medical Journal* by Mr. E. J. Lowe, F.R.S., and apparently resting on his personal observation. The lasting effects of coition in the male are especially curious. The cases are as follows:

1. A white sow was sired by a black Berkshire boar and produced a litter of black and white pigs; this sow was next sired by a red Tamworth boar, and although there was no black in either of the parents the progeny were red, black and white, the patches of black being very conspicuous.

2. A black sow and boar (Duckering breed) had always bred their progeny black. The boar then sired a white sow for the first time; two months later it was sire of the original black sow, which then produced a litter of black and white pigs, although there was no white in either of the parents.

3. An Alderney bull sired a shorthorn cow, the calf being a half-bred Alderney. Afterwards this same cow was sired by a shorthorn bull, but still the calf was partly Alderney.

4. A smooth fox terrier was sired by a rough Scotch terrier, and had rough pups; it was then sired by a smooth fox terrier, but the pups were many of them rough-coated, and none were like the parents.

5. A Manx tailless tom-cat was sire to an ordinary English cat, and a portion of the kittens had either no tails or very short ones. The tailless tom-cat died some years ago, but up to the present time a few tailless kittens are born.

6. A fair light-haired Englishman married a Brazilian lady, but had no children. Twenty years after he married a light-haired English lady, who subsequently had a dark-haired son that was more a Brazilian in appearance than English.

Among the lectures to be given at the Franklin Institute, Philadelphia, during the present season are the following:

Oct. 30, Dr. Edwin J. Houston, professor of physics, Franklin Institute. 'X-rays.'

Nov. 13, Prof. W. O. Atwater, Wesleyan University, Middletown, Conn. 'Metabolism of Matter and Energy in the Animal Body.'

Nov. 20, Mr. Henry G. Bryant, Philadelphia. 'Characteristics of the most Northern Eskimos.'

Nov. 27, Dr. Joseph W. Richards, Lehigh University, Bethlehem, Pa. 'The Cyanide Process for the Treatment of Gold Ores.'

Dec. 4, Prof. Henry Trimble, Philadelphia College of Pharmacy, Philadelphia. 'Recent Advances in the Study of the Resins.'

Dec. 11, Mr. Francis A. Fitzgerald, with the Carborundum Co., Niagara Falls, N. Y. 'Manufacture and Development of Carborundum at Niagara Falls.'

Dec. 18, Mr. H. M. Chance, mining engineer and geologist, Philadelphia. 'Applications of Electricity in Gold Mining.'

Jan. 4, Lieut. Bradley A. Fiske, U. S. N. 'Electricity in Warfare.'

Jan. 8, Mr. Henry Harrison Suplee, consulting engineer, Philadelphia. 'Locks and Fastenings of Security.'

Jan. 15, Mr. John Carbutt, Philadelphia. 'The Practice of the New Photography.'

Jan. 22, Chas. B. Dudley, Chemist to the Penna. Railroad Co., Altoona, Pa. 'The Ventilation of Passenger Cars on Railroads.'

Jan. 29, Dr. Karl Langenbeck, Supt. of the Mosaic Tile Co., Zanesville, Ohio. 'Chemistry in the Pottery Industry, and some recent Improvements in Imperishable Decorations in Clay Tiling.'

Feb. 5, Dr. Lee K. Frankel, Analytical Chemist, Philadelphia. 'Food Adulteration and the Pure Food Law.'

Feb. 12, Rev. Horace C. Hovey, D. D., Newburyport, Mass. 'The Mammoth Cave and other Magnificent Caverns.'

Feb. 19, Dr. Daniel G. Brinton, Media, Pa. 'The Weights and Measures of Primitive Peoples.'

Feb. 26, Mr. Harold M. Duncan, with the Lanston Monotype Machine Co., Washington, D. C. 'Machine Substitutes for the Composition of Types by Hand.'

March 5, Col. Ira Ayer, Special Agent U. S. Treasury Department, New York. 'The Tin Plate Industry in the United States.'

March 12, Prof. D. S. Jacobus, Stevens Institute of Technology, Hoboken, N. J. 'Artificial Light: Modern Methods Compared—Electric-Incandescent, Welsbach, Acetylene.'

March 19, Prof. W. P. Mason, Rensselaer Polytechnic Institute, Troy, N. Y. 'Sanitary Problems connected with Municipal Water Supplies.'

March 26, Mr. Alfred E. Hunt, President Pittsburg Reduction Co., Pittsburg, Pa. 'The development of the Use of Aluminum in the Arts.'

April 2, Dr. Conrad Berens, Philadelphia. 'Deafness and its Causes.'

April 9, Mr. George F. Kunz, with Tiffany & Co., New York. 'Precious Stones as they have influenced Geography.'

May 14, Prof. John B. DeMotte. Bryn Mawr, Pa. 'The Physical Basis of Mind.'

MR. J. D. WEEKS has just made a report, says the *Railroad Gazette*, on the supply of natural gas and its decline, from which it appears that the supply has fallen to half in seven years. In 1888 the value of the gas produced was $22,629,875. In 1895 it was $13,006,650. In Pennsylvania the fall has been much greater than in Ohio and Indiana. In 1888 the gas produced in Pennsylvania was worth $19,282,375; in 1895 it was $5,852,000. The decrease has been less rapid since 1891, owing to the general introduction of meters, but it has gone on at the rate of about 5 per cent. a year. As the product shrinks rapidly when pressure falls, it may not be over 10 or 15 years before very little gas is produced.

IT is announced that the *Edinburgh Medical Journal*, which is now owned by Mr. Young J. Pentland and is to be edited by Dr. G. A. Gibson, begins a new series with the issue for January, 1897.

THE report of the Manchester Museum for 1895–6 (says *Natural Science*) notes the importance of the recognition of the museum as a public institution by the Manchester City Council, in that a sum of £400 has been apportioned to the museum out of the Free Library Rate. The average Sunday attendance is 519, and may be considered highly satisfactory, seeing that the largest attendance ever recorded on a week day was 1,079. The increase in the collections and library is very marked. The arrangement of the minerals by Mr. Gilbert Rigg, under the supervision of Dr. Burghardt, has been completed as far as the end of the silicates, and it is hoped that a guide to this collection may shortly be published.

UNIVERSITY AND EDUCATIONAL NEWS.

THE tenth annual convention of the Association of Colleges and Preparatory Schools of the Middle States and Maryland was held at the University of Pennsylvania on November 27th and 28th. The subject to which the meeting was especially devoted was the consideration of college entrance requirements. The requirements in history and in science were discussed separately, the latter by Prof. Ira Remsen, Prof. George F. Barker and Mr. O. D. Clark. The conference on college entrance requirements, with special reference to the age at which students now enter college and graduate from the professional schools, was taken part in by a large number of speakers, including Superintendent Edward Brooks, Philadelphia; President Eliot, Harvard University; Vice-Provost Fullerton, University of Pennsylvania; President Gilman, Johns Hopkins University; Commissioner of Education Harris; Chancellor Holland, Western University of Pennsylvania; President McCracken, New York University; President Patton, Princeton University; President Schurman, Cornell University; President Sharpless, Haverford College; President Thomas, Bryn Mawr College; Principal Thurber, Morgan Park Academy, and President Warfield, Lafayette College. On the evening of November 27th Dr. J. C. McKenzie gave the President's address, and brief addresses were made by Superintendent Brooks and President Eliot.

THE Hamilton Court Building Company, composed of friends of Columbia University, have bought for about $200,000, sixteen lots having a frontage of 200 feet on the east side of Amsterdam avenue and a depth of 200 feet on 121st and 122d streets. It is proposed to erect at a cost of $1,000,000 a dormitory that will accommodate about 900 students.

THE Board of University Regents in California have decided to locate in San Francisco the trade school for boys endowed by the late J. C. Wilmerding with $400,000.

THREE new instructors have been appointed at the University of Vermont: Dr. David Irons in Philosophy, Dr. W. G. Bullard in Mathematics and Mr. F. S. English in Civil Engineering.

LORD REAY has been proposed for election as President of University College, London, in the room of the late Sir John Erichsen.

THE Austrian government proposes to admit women after next year to all faculties of the Universities except theology.

ABERDEEN UNIVERSITY will add a wing for science at a cost of about $50,000. The government has refused a grant for the purpose, but it appears that the city will pay the cost in return for land given by the University Court.

THE following appointments are taken from the *naturwissenschaftliche Rundschau:* Dr. Knövenagel, of the University of Heidelberg, has been made associate professor of chemistry; Dr. Wladislaw Rothert, associate professor of botany in the University of Kasan; Dr. Seitaro Goto, professor of botany in the First High School at Tokyo, Japan; Dr. Kepinsky, associate professor of mathematics at the University of Krakau; Dr. Dalwigk has been recognized as docent in mathematics in the University of Marburg, and Dr. Beer as docent in comparative physiology in the University at Vienna.

DISCUSSION AND CORRESPONDENCE.

THE DATE OF PUBLICATION.

IN SCIENCE for November 20 (N. S., Vol. IV., No. 99, pp. 760, 761) Prof. E. D. Cope has appeared in defense of the resolution adopted by the Zoological Section of the American Association for the Advancement of Science, criticised by me in the issue of SCIENCE for November 6th (N. S., Vol. IV., No. 97, pp. 691–693). I am glad to see that in this reply Prof. Cope has clearly defined the issue. It is comprised in the following statement: "The test of publication is according to Dr. Allen that it be offered to the public. I agree with this, but hold that the only determinable test of date of offering to the public is the date of printing. The presumption is that as soon as a book is printed and bound it is offered to the public. That is the object of printing books."

It is gratifying to find that Prof. Cope agrees that the test of publication is the offering of a work to the public. As he says, in the case of books issued for sale, it does not matter whether or not any copies are sold, the book is published when it is offered for sale.

On the other hand, his contention that the "date of offering to the public is the date of printing" is an amazing misconception of what constitutes publication. Yet he concedes that, "in case of the detention of a book by the government subsequent to the printing the question of the coincidence of the date of printing and of 'offer to the public' will depend on whether copies of the book can be had on demand or not. If the book can be had it is 'offered to the public.' If it cannot be had it is not offered to the public." In this statement Prof. Cope, in trying to obscure the issue, fairly begs the question, and implies a condition of things that does not exist, as no one probably knows better than himself.

To speak in general, and in relation to other points raised by Prof. Cope, he says: "The date of printing, or alleged printing, of the last part of a book, the title page, has always been regarded as the date of publication. * * * We are accustomed to refer to the title page, or last page, to ascertain this date, for further than this we cannot go." This is quite true when there is not palpable evidence of misdating, particularly of antedating. Hence the rule generally adopted by scientific bodies, as stated in my former paper, "to the effect that the ostensible date, as that given on the title page of a book or pamphlet, or at the bottom of the signatures, shall be taken as the correct date, *unless known to be erroneous.*" This rule is not only approved by Prof. Cope, but he strangely claims that it is in essential accord with the resolution of the Zoological Section of the American Association for the Advancement of Science, which, as he, himself, states it, 'recommended that the date of printing be regarded as the date of publication.'

In the case of the majority of works issued in the past, or at periods too remote to bear obvious evidence of having been antedated, and especially of works issued by responsible publishers, the ostensible date must be accepted. This fortunately covers a large part of scientific literature, but strangely and most unfortunately does not always include the proceedings, memoirs and other publications of scientific societies, the ostensible dates of publication of which are not to be relied on, a fact now thoroughly well known. There are, of course, many exceptions, when the ostensible date is the correct date, and in many other cases the approximately correct date is determinable.

Prof. Cope states: "The probabilities are so great that a book is 'offered to the public' at the date affixed to it that it is not safe to assume that it is not, except in two contingencies." One of these is the fraudulent antedating of a book; the other is that "brought forward by Dr. Allen, that the government publications which are issued at a date later than that which they carry on their title pages." This latter case Prof. Cope claims 'is not well taken,' because, "although some reports issued by our government may bear dates much prior to the dates of issue, it does not follow that the date of printing bears any such relation to the date of issue!" Yet he tells us in another paragraph, as already quoted, that we must accept the date given on the title page as the date of publication! Sometimes a government scientific report is issued reasonably near the date it bears, but, at least in recent years, this is the exception rather than the rule, even with publications issued by the U. S. National Museum. This, of course, is not the fault of the authors, nor even of the Museum,* but is due to the peculiar ways of the Government Printing Office. Nor is the United States government the only offender; things are not managed any better under State Printers, and in some cases even worse. Columns of this JOURNAL could be filled with titles of State reports on geology and natural history bearing dates one to three years prior to the dates when the first copies were distributed, although the final proofs were read by the authors, and the pages probably printed in conformity with the date on the title page. And during the interval between the dates of printing and distribution copies of the works were *not* to be '*had on demand*,' even by the authors.

Hence it would seem that no one possessing a knowledge of these facts can candidly contend "that the date of printing [should] be regarded as the date of publication." In the case of official documents issued by the different States or by the general government, the date of distribution, or *publication*, is doubtless quite as easy to determine as the date of printing.

The 'whereases' preceding the resolution here under consideration, relating to the difficulties of determinating 'a rule of distribution,' were not considered in my former communication—a fact to which Prof. Cope calls attention—nor are they now, since for the most part they are obviously of little weight, and are sufficiently covered in considering the resolution itself.

J. A. ALLEN.

AMERICAN MUSEUM OF
NATURAL HISTORY, NEW YORK.

*The articles in the Proceedings of the U. S. National Museum are distributed separately to specialists, and to some extent to libraries, as soon as printed, but of late they are sent out without date. There is nothing on the title pages to show when they were issued. When the volume to which they belong is completed and issued, six months to a year after some of the papers were distributed, the date of distribution of each article is given on a leaf following the table of contents. As the early distribution of 'separates' of articles is obviously to secure an early date of publication, the desirability of adding the date is obvious. As this is a matter apparently within the control of the officials of the Museum, there may be some practical difficulty in the way of affixing a really correct date that is not obvious to the public.

VITALITY OF THE SPERMATOZOON.

AN instance that may illustrate some of the physiological properties of the mature male sex cells was observed last summer in the course of instruction in invertebrate zoology at the Marine Biological Laboratory at Woods Holl, Mass. Illustration is also given of the rate at which the more interior tissues may harden when the entire animal is subjected to the action of alcohol.

When the study of Mollusca was begun, a

large number of 'short clams' (*Venus mercenaria*) were brought into the laboratory to be used in dissection. It was the plan of the instructors to harden a portion of these in such a way that thick free-hand sections of the whole animal could be made, thus to aid in demonstration of the anatomy. To accomplish this result quickly, as we supposed, it was decided to place them directly into commercial alcohol.

About five dozen specimens were, therefore, selected for this treatment; one of the valves of the shell of each was crushed, in order to allow the fluid to penetrate freely into the mantle chambers, and the whole number was then placed in a large aquarium jar and covered with 95% alcohol. This was at about eleven o'clock in the evening of July 15th. The material was not used on the next day, and so lay undisturbed until ten o'clock of the day following, *i. e.*, July 17th, a period of not less than 35 hours. A series of thick sections was then made by one of the students in the course, Mr. N. B. Sloan, of Hillsdale College, and laid out in a dish of fresh sea-water. In order to determine the sex of the specimen so treated, a bit of the gonad was shown by him to be that of a male, in which the sex cells were not only mature but were also showing their characteristic movements in an unmistakable manner. The attention of the instructors was called to this, and the fact that the cells were alive was tested by adding a drop of corrosive sublimate at which all the movements quickly ceased.

These germinal cells were toward the interior of the visceral mass of the clam, and if the influence of the alcohol had reached them at all through the investing sheath they were at least able to resist it and to resume their normal activities under the proper conditions. Whether any of the somatic cells of the same tissues of the animal were also living, such as the leucocytes, was not tested, but even if no alcohol had reached these germ cells, yet under the adverse conditions, inasmuch as the ordinary life processes of the animal had been so long suspended, their vitality is remarkable.

It may be, therefore, inferred that as they reach maturity the spermatozoa of this lamellibranch may possess the ability of withstanding many unusual conditions of the surrounding water into which they may be shed. But whether it implies a long continued or a temporary vitality was not sought by us; nor was it attempted to show by experiment whether these sexual elements could withstand greater chemical changes in the ordinary sea-water than can the smaller marine Protozoa, for example. It is certain, however, that as far as this species is concerned, great promise is inherent in the spermatozoa for obtaining the necessary distribution.

J. I. Peck.

THE APPEARANCE OF THE MOON.

To the Editor of Science: The following incident might supplement Mr. Brinton's interesting account of the different pictures different persons see in the moon. I was a member of a jury in an important case a few months ago and the members were much more than ordinarily intelligent. While out for a walk in charge of the sheriff one evening, the full moon was coming over the hills to the east, and I suggested that each man write down the impression it gave him as to size. The slips were deposited in a hat, and when drawn out the comparisons ran from 'the size of a twenty-dollar piece' up to 'twelve feet.' When near to the horizon it struck me as being about eleven inches across, and several put it about that, but the thirteen men made it all sizes, four, six, ten inches, three feet, five feet, etc. One man said it was the size of a flour barrel and another of a buggy wheel, etc.

R. L. Fulton.

Reno, Nevada.

SCIENTIFIC LITERATURE.

Grundriss einer exacten Schöpfungsgesichte. Von Hermann Habenicht. Vienna, Hartleben. No date. 136 pages, 7 folded plates.

Habenicht has been for many years one of the expert cartographers in the geographical establishment of Justus Perthes at Gotha. His competent and sincere work in this exacting field must secure him a courteous hearing if he has anything to say about the world as a whole, so much of which has come, at second hand, under his fingers; but in the collection of his essays under the above title, the fruit of nearly forty years of professional, morphological study of the earth's surface, the deference that we owe

to a senior worker is severely tried. The book claims to be the first attempt to unite the well-established facts of astro- geo- and experimental-physics, and to refer the form of continents and sea basins, mountain chains, volcanoes and earthquakes, fossils, glacial periods, etc., to a single fundamental law of nature. The argument is briefly as follows: The cooling of the earth is discarded as a cause of surface crumpling, not because the process is insufficient, but because such cooling would—it is alleged—cause only tensile and not compressive forces in the crust (a complete misapprehension of the hypothesis). Insomuch as temporary stars have been explained as explosions of occluded gases, it is concluded that overwhelming catastrophes might thus be caused on the earth. The huge craters produced by such eruptions are most gratuitously assumed to be the means of determining the leading lines of terrestrial relief; the collapsing of the craters causes the lands to slide and wrinkle; and inasmuch as the successive catastrophes must have extinguished all forms of life, evolution is brushed aside and the Mosaic account of creation is re-established. The author's graphic skill is employed to illustrate the post-Tertiary changes of the continents in a series of six beautiful diagrams, whose absurdity would be amusing were their imaginative innocence not plaintive.

Much more might be said; but less would hardly constitute fair mention of a book that claims to be the 'outline of an exact cosmogony.'

W. M. D.

SOME RECENT RESEARCHES ON THE CHEMISTRY OF THE CELL.*

MIESCHER'S untimely death, after many years of patient work, left his epoch-making researches upon the chemical composition of the sperm of the salmon still unfinished. The results contained in the paper here reviewed represent but a small part of all that he accomplished, but this much only was it possible for Dr. O. Schmiedeberg to collect and put together from Miescher's scattered notes. Regarding the structure of the spermatozoon Miescher has little to add to his account of 1874. The head of the sperm consists of a hull and an inner substance. The hull was of alkaline reaction since it stained in decolorized cyanin, but not in methyl green. The inner substance stained deeply in methyl green. The head also contained a so-called 'Centralstäbchen,' apparently a prolongation of the tail forward into the head. No middle-piece could be distinguished.

1. *Histo-chemical Isolation.*—If the ripe, quite fresh sperm be centrifugalized, the sperm-fluid in which the spermatozoa float may be separated from them. This fluid was found to contain 0.19% organic constituents (a mere trace of albumen), and 0.75% inorganic salts, chiefly NaCl, Na_2CO_3, KCl and K_2SO_4. It is evidently a harmless fluid, analogous to physiological salt solution, in which the spermatozoa are suspended and which serves only to give the sperm-mass the necessary fluidity for ejection.

If, after removal of this fluid by Glauber's salts solution (in which the spermatozoa remain intact) the clean sperm be extracted with successive portions of water and many times centrifugalized, the tails swell and pass over into the fluid, leaving behind a sediment of sperm-heads. In this way it is possible to obtain separately heads and tails in sufficient quantities for separate analysis. Under the microscope the heads are seen to retain intact their characteristic form. Collected under alcohol they look like an inorganic, heavy, snow white powder like barium sulphate or calcium oxalate.

2. *Constitution of the Tails.*—Analysis of the substances obtained from the tails isolated in this manner show that they consist of 41.9% albumen not farther investigated; 31.83% lecithin, a body generally present in all cells but especially abundant in nerve-tissue; and 26.27% of fats and cholesterin. The fats consist of fatty acids, which occur as soaps. The tails contain no nucleic acid or protamin. In a letter to W. His the author writes: "The farther I go with the tails, the more probable it seems to me that we have before us essentially

*1. F. Miescher. Physiologico-chemical Researches on the Sperm of the Salmon (contributed by O. Schmiedeberg): Archiv für Experimentelle Pathologie and Pharmakologie, XXXVII., 1896.

2. A. Kossel. On the Basic Stuffs of the Cell-nucleus: Zeitschrift für Physiologische Chemie, XXII., 1896.

the chemical type of the non-medullated nerves, *i. e.*, of the axis cylinder."

3. *Composition of the Sperm-Heads.*—The analysis of the sperm-heads led to the surprising result that it is practically possible to express their constitution in a chemical formula, *i. e.*, that they are almost exclusively composed of one chemical substance. This substance is protamin nucleate,

$$10(C_{40}H_{54}N_{14}O_{17},2P_2O_5,\ C_{16}H_{28}N_8O_2)$$

nucleic acid. protamin.

$$+ C_{40}H_{54}N_{14}O_{17}2P_2O_5$$

free nucleic acid.

For this research the heads were first extracted with ether-alcohol to remove the last traces of lecithin. The substances thus obtained were generally soaps, and amounted to only 0.74–2.56%. *The lecithin of the spermatozoon is thus shown to be confined entirely to the tail.* The poverty of the head in ether extractive is in striking contrast to the richness of the tails in such stuffs. The residue of the sperm-heads consists almost wholly of a mixture of the nucleic acid and basic protamin salts of nucleic acid.

The protamin, a simple albuminous body also isolated by Kossel from Sturgeon sperm, was isolated by treating the sperm with 0.25–0.50% HCl. The protamin passes into solution, the nucleic acid remains behind. There was thus obtained 19.78% of the sperm-heads as protamin. The hydrochloric acid extract also contained some calcium, iron, and calcium phosphates amounting to 2.94%.

The residue, after extraction of the protamin, consisted in large part of nucleic acid, a substance characteristic of all chromatins thus far examined. This constitutes, according to the phosphorus determination, about 60.50% of the sperm-head. The greater part of this nucleic acid is readily soluble in dilute sodium hydrate. There was thus actually isolated from the heads 95% of the total nucleic acid calculated to be present from the phosphorus content. It is certain from this determination that the total amount of phosphorus in sperm free from lecithin, except the trace occurring as phosphates, is contained in the nucleic acid.

After extracting the protamin and nucleic acid a small residue of the heads remained undissolved. This proved to be a compound of nucleic acid and protamin which had been slightly altered by the action of the extracting acid used, and so rendered less soluble.

From these analyses the composition of the salmon sperm is as follows: In sperm freed from lecithin and fat 87% of the substance lies in the head, and 13% in the tail. Of the original unextracted sperm (containing lecithin) 76% lies in the head and 24% in the tail. The tails consist of 41.9% albumen, 31.83% lecithin, and 26.27% fats and cholesterin. The heads consist of 35.56% protamin, and 60.50% nucleic acid, or 96.06% of neutral protamin nucleate. Of the other 4%, 2.5% were insolated as gypsum and calcium. The other 1% probably consists of albumen.

"The result that the fat-free heads contain 96% of protamin nucleate is astonishing. Since this salt is not an organized structure (Gebilde) it is questionable whether the heads, on the whole, contain any such. That the albuminous matter out of which such a structure must be compounded should be separated with the tails on the isolation of the heads is not to be considered, because the heads, after the isolation of the tails, on microscopical examination have the same appearance as before. Treatment with eosin, after good isolation, shows no trace of tail, middle piece, or other albuminous substance remaining behind, while the inner space may by the respective reagents be as beautifully differentiated as before. It (the inner space) has certainly a different nature from the hull, although both consist of the same substance. This difference rests apparently on the fact that nucleic acid and protamin are not uniformly distributed in the heads as a neutral salt, but in such manner that the *basic* protamin salt of nucleic acid occurs on the surface, and the *acid* protamin salt in the interior. This is indicated also by the fact, above mentioned, that after treating the heads with hydrochloric acid the nuclear colors are then also taken by the hull. That the hull has an alkaline reaction is proved by their blue coloration in decolorized cyanin solution, while the inner space remains uncolored."

"If the sperm, nevertheless, contains a special living structure (Gebilde) or a ferment-

stuff, the mass of the latter compared to that of the heads can only be extraordinarily small." Schmiedeberg then suggests that in such case the protamin nucleate might be the protector of this. This suggestion will hardly be accepted by those who believe in an active physiological *rôle* of the chromatin, since there can be no doubt that the protamin nucleate is the sperm-chromatin.

Miescher has also some interesting results on the differentiation of the chromatin (nuclei) during the formation and ripening of the sperm.

By treatment of the unripe testes with a solution of sodium taurocholate and calcium chloride, the nuclei of sperm-mother-cells and spermatocytes were isolated free from cytoplasm. *No protamin could be obtained* in the acid extract of these nuclei, although it may possibly have remained undissolved. There was obtained, however, an albuminose which proved to be practically identical in composition with a so-called deutero-myosinose isolated by Chittenden and Kühne from muscle. This is most interesting in the light of the fact that the salmon takes no food after entering the Rhine, and the material which serves as food for the developing testis is derived, as Miescher showed, from the body-muscles. Apparently, therefore, we have, in this fact, a chemical proof that the food-substance is taken into the nucleus. There can be little doubt that this albuminose is the mother-substance from which the protamin is differentiated during ripening. This fact is also in harmony with Kossel's observation that protamin can not be isolated from the unripe testis, and that protamin forms a combination with albuminoses not to be distinguished from the histon isolated from other nuclei.

Kossel's paper, published almost coincidently with that of Miescher, is of particular interest for two reasons: first, because Kossel finds protamin present in the sturgeon sperm as in the salmon; and second, on account of the important character which Kossel shows protamin to have. He finds that the sturgeon sperm yields protamin and nucleic acid, like the salmon, but contains a larger percentage of albumen. The protamin constituted, in the form of the sulphate, about 20% of the dried sperm (freed from fat and lecithin). The chemical analysis coincided with that obtained by Miescher in the protamin of salmon sperm, with the exception that sturgeon protamin contained one molecule more water. This may have been due, however, to incomplete drying. In physical character the two protamins differed. Thus, salmon protamin sulphate is easily soluble in hot water and on cooling separates out as an oil, while that of the sturgeon remains dissolved on cooling. The sturgeon protamin, too, is not so easily precipitated in strong salt solution as the salmon. Kossel also isolated substances resembling protamin and nucleic acid from the testes of the trout and the whiting, so that we are tolerably sure that a large portion of the sperm head of fishes consists of protamin nucleate.

Perhaps the most interesting part of the paper is that concerning the chemical nature of protamin. This substance is a basic body which gives all the reactions of albumen except that of Millon. Inasmuch as the latter reaction depends on the presence of certain radicles contained in albumen, these are seen to be lacking in protamin. Prof. Kossel suggests that protamin is the essential kernel of all albumens. We seem to have in protamin an albumen in the lowest terms. This is shown by the fact that on its decomposition protamin yields those products, arginin and lysin, which have so far been isolated from all albuminous bodies studied, but gives these products in very much larger proportion than albumen. Apparently albumen is protamin plus a greater or less number of other radicles.

The amido-acids were almost entirely lacking among the decomposition products. It is thus shown that protamin differs from the peptones in lacking the group out of which the amido-acids are formed. It follows also that the so-called biuret reaction of albumen is dependent on that group which falls into arginin and other bases.

Protamin unites in ammoniacal solution with albumoses, forming thereby bodies which could not be distinguished from the histon isolated by Kossel and Lilienfeld from the nuclei of the thymus gland. There are thus formed new albuminous bodies, which will yield more arginin than the original albumoses. "If we assume that this combination (Anfügung) also

takes place in the cell, we have an explanation of the fact, observed by Hedin, that different albuminous bodies yield on hydrolysis different amounts of arginin.''

The fact that we have finally procured in protamin a chemically pure substance of a comparatively simple nature, which is, in all probability, the fundamental radicle of albumen, is of the very greatest importance in the study of the composition of the albumens, and may, perhaps, lead ultimately to their artificial formation.

In a third paper, 'On the Formation of Thymin from the Fish-sperm,' Kossel shows thymin to be a decomposition product of the nucleic acid of the sturgeon sperm, just as it is derived from the nucleic acid isolated from the thymus gland. He establishes its identity, also, with the body called 'nucleosin,' isolated by Schmiedeberg from the salmon sperm nucleic acid. From this there can be little doubt that these three acids are very closely similar in structure.

It has recently been found by the reviewer, in Kossel's laboratory, that the sperm of the sea urchin, *Arbacia*, also consists largely of protamin and nucleic acid.

It seems probable, from these results, that the head of the spermatozoon generally is composed of two very interesting substances, of nucleic acid, the essential chromatic constituent probably of all chromatins thus far isolated, free or combined, from yeast, pancreas and thymus gland; and of protamin, the radicle of albumen. The sperm seems to have rid itself of all superfluities and taken the essentials in their most compact form.

From Miescher's work we also have a good idea of the chemical nature of the sperm tail, although it is probable that the lecithin isolated therefrom is in reality combined in life with the albumen. As to the chemical nature of the middle piece little or nothing is so far known, but it is possible that, if the methods of histochemical isolation used by Miescher shall be found generally applicable, something may in time be learned of this.

We are still uncertain whether the protamin nucleate is identical in composition with the chromatin in the head of the living sperm, or whether in the process of isolation it has in some way changed, but the latter may not improbably be the case. At any rate it cannot be long until we have a general comparative chemistry of the chromatins, just as we have at present of the nucleins. The work of Kossel and Lilienfeld upon the chromatin of the calf's thymus, that of Kossel and Altmann upon the chromatin of yeast, of Hammarsten upon the pancreas chromatin, of Kossel upon the chromatin of the sturgeon's sperm and salmon, and that of Miescher upon the salmon sperm form the first stones of the foundation.

Albert Mathews.

SCIENTIFIC JOURNALS.

THE PHYSICAL REVIEW, VOL. IV., NO. 3, NOVEMBER–DECEMBER, 1896.

Experimental Determination of the Temperature in Geissler tubes: By R. W. Wood. It has been admitted for some time past that the light effects in Geissler tubes cannot be interpreted as indicating a high temperature. The phenomenon is unquestionably one of luminescence. Several writers, among whom Warburg may be especially mentioned, have discussed the theory of the phenomenon, and have arrived at results indicating that the temperature in an active Geissler tube is not greatly above the temperature of the surrounding air.

Mr. Wood has undertaken the difficult problem of actually measuring the temperature in the interior of a Geissler tube, making use of a fine wire bolometer so arranged that it could be moved from point to point through the tube. His results are, in the main, in agreement with the predictions of Prof. Warburg. The temperature in no case exceeds that of the surrounding air by more than 20 or 30 degrees. The temperature, however, is not found to be constant throughout the tube, but varies in accordance with definite laws throughout the space separating the two electrodes. The most striking results obtained by Mr. Wood apply to the case of a stratified discharge. In the curves which he presents to show the variation in temperature from point to point, a well defined ripple is seen corresponding to each layer or stratification. In passing from a bright layer

to the adjacent dark space a sudden temperature change amounting to four or five degrees was observed in almost all cases.

It can hardly be doubted that Mr. Wood's results will prove of great assistance in the development of the theory and explanation of Geissler discharge phenomena.

The Specific Heats of the Metals: By F. A. WATERMAN. Dr. Waterman's article contains, first, a critical discussion of the methods heretofore used in the determination of specific heat, which is accompanied by a table giving the values obtained by various experimenters. This table appears to have been prepared with much care and will be found extremely useful. The paper also contains the description of a new form of calorimeter devised by Dr. Waterman and used by him in determining the specific heats of bismuth, tin, aluminum, copper, gold and zinc. A description of the apparatus is beyond the limits of this abstract, but the instrument seems to be capable of a high degree of accuracy, and the results are thoroughly concordant.

Dr. Waterman has used especial care in obtaining pure specimens of the metals studied, and in this way avoids what is perhaps the commonest source of error in previous determinations.

The Viscosity of Mercury Vapor: By. A. A. NOYES and H. M. GOODWIN. Determinations of the viscosity of mercury vapor, hydrogen and carbon dioxide were undertaken by the writers, with the object of finding whether the viscosity of a gas can be made to furnish a criterion for distinguishing between monatomic and polyatomic molecules. As the authors very justly state, the recent discussions in connection with the atomic weight of argon have thrown some discredit on the indications of the specific heat ratio in this connection.

The kinetic gas theory shows that a simple relation exists between the viscosity of a gas and the cross section of the gaseous molecule. If the space occupied by a molecule is widely different from that occupied by an atom, we should therefore expect the viscosity of a monatomic gas such as Hg to differ widely from that of a diatomic gas like H. Such differences were however not found. Messrs. Noyes and Goodwin conclude that the space occupied by a molecule is of the same order of magnitude as that occupied by an atom, and that the viscosity can therefore not be used to determine the molecular complexity.

An Example in Thermometry: By A. S. COLE and E. L. DURGAN. The piece of work described in this paper was undertaken at the suggestion of Prof. Wm. A. Rogers, and has to do with the calibration of a mercury thermometer. The object of the paper is to give a description of the methods used in such calibrations, with sufficient detail to enable one to become thoroughly familiar with the process. The thermometer studied was one of those employed by Profs. Morley and Rogers in their work on the coefficient of expansion of Jessop's steel.

A Study of the Apparent Capacity of Condensers for Short-charge Periods: By H. V. CARPENTER. The 'soaking in' of a charge in a condenser is a phenomenon whose existence has long been known, and for which various explanations have been suggested. As is well known, the phenomenon leads to troublesome complications when it is desired to measure the capacity of a condenser, for the amount of charge taken up by a condenser will depend upon the duration of charging. Mr. Carpenter has undertaken to determine experimentally the variation in the apparent capacity due to this cause, as the period of charge is increased from a few thousandths of a second up to about half a second. Data are given for a mica condenser, a condenser made of paraffined paper, and one furnished by the Stanley Electric Manufacturing Company. The charging circuit was made as nearly as possible non-inductive, so that the effect studied could be separated from the similar effect which might be produced by self-induction. Results are shown in form of curves giving the variation in the charge as a function of the time of charge. Observations were made at various voltages. It appears that the rapidity of absorption varies greatly with different condensers. It seems also to depend somewhat upon the potential to which the condenser is charged. The rate of absorption is found not to be proportianal to the potential difference. Mr. Carpenter's curves indicate great uniformity in the behavior of a given condenser, and while

the laws of the phenomenon cannot yet be derived they at least appear to be definite.

Note on the Osmotic Theory of the Voltaic Cell: By H. M. Goodwin. Prof. Goodwin dissents in this article from some conclusions reached by Prof. Bancroft in a recent paper on 'The Chemical Potential of the Metals,' and presents results of recent determinations of the E. M. F. of certain types of cells in support of his position.

The Division of an Alternating Current in Parallel Circuits with Mutual Induction: By Frederick Bedell. This paper is devoted to a discussion, both graphical and analytical, of the case of branch circuits which act inductively upon one another. The general formulæ are derived and several special cases are considered. The results are not of a character which could be presented here to advantage.

On the Specific Gravity and Electrical Conductivity of the Normal Solutions of Sodium and Potassium Hydroxides, and Hydrochloric, Sulphuric Nitre and Oxalic Acids: By E. H. Loomis. The results of careful determinations of the specific gravity and conductivity are here presented in the case of some salts and acids for which these quantities had not previously been accurately determined.

New Books.—Wuller: Experimentalphysik. Carhart and Patterson: Electrical Measurements. Le Blanc: Electrochemie. Fleming: Alternate current transformer. Bedell: Principles of the Transformer.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES.

The Section of Geology and Mineralogy, held its regular monthly meeting November 16th, with Prof. Albert H. Chester in the chair, as chairman *pro tem.*

The first paper was by Dr. E. O. Hovey, entitled 'On a Deep Well-boring at Key West, Fla.' Dr. Hovey described the geological section uncovered by the well for a depth of more than 2000 feet. A number of microscopic organisms were obtained. It proved somewhat difficult to identify the geological horizons, but without much doubt the well penetrated a considerable distance into Miocene. In the limestone many grains of quartz, possibly of secondary depositions, were met, and also rolled grains of quartz, doubtless in the nature of sand. Dr. Hovey commented on the significance of the phenomena, and expressed his obligations to Prof. Alexander Agassiz, from whom the samples had been obtained. The paper will appear in full in an early number of the Bulletin of the American Museum of Natural History.

Prof. A. J. Moses then exhibited a number of new mineralogical instruments which had recently been sent from Europe. They included a little adjustable dark room which could be fitted to a Fuess No. 2 Goniometer, so that crystals could be measured by daylight. Perfect signals could be obtained even in a well-lighted room. The instrument is called the Traube Verdunklungsvorrichtung. The universal rotation attachment for mineralogical microscopes which has been invented by Prof. Klein, of Berlin, for measuring the angle of the optic axes of microscopic crystals was also shown. Klein's new rotation apparatus for the orientation of thin sections was next described. The new attachment which can be adjusted to the Fuess Goniometer No. 2 for measuring the optic axes was shown and an opportunity was afforded to test it by actual experiment. The von Federow mica wedge (Glimmerkeil), which consists of a series of superposed $\frac{1}{4}$-undulation mica plates in step-like arrangement and is used for all the purposes of a quartz wedge, concluded the paper.

The third paper was read by Mr. A. Chester Beatty, and was entitled 'The Minerals of the Elkhorn Mine, Montana.' Mr. Beatty exhibited with comments, a remarkable series of calamine, smithsonite, native silver and other minerals.

Prof. A. H. Chester presented a paper on the new discovery of the brassy, micaceous mineral which seems, from the only analysis, to be chalcodite, and which has been found in a quarry at Rocky Hill, New Jersey. He also exhibited a remarkable series of rutile from Graves Mountain, Georgia.

G. F. Kunz described a new meteorite from Guatemala, and read a joint paper by Dr. Hillebrand and himself upon a new discovery of prosopite in Utah. He read also a joint paper by J. H. Pratt and himself on the new find of saphires at Utica, Mont.

Mr. Frederick Braun described his discovery of spinels and chondrodite in dolomite, at Fordham, New York City, an association closely resembling that at Edenville, N. Y. It was discussed by Prof. J. F. Kemp, who remarked on the interest attached to this association of minerals because of the difference of opinions prevailing among geologists as to whether they indicated contact metamorphism or merely regional metamorphism.

The last paper of the evening was by Prof. J. F. Kemp, entitled 'Exhibition of interesting minerals collected during the summer.' The speaker exhibited covellite, goslarite, enargite, chalcodite and tetrahedrite from Butte, Montana, which were exceptionally fine crystals. Remarkably large prisms of andalusite from the Black Hills were also shown and zircons and allanite from Mineville, Essex County, New York.

A collection of chalcodite from a quarry near Reading, Pennsylvania, was exhibited by Mr. Roebling, of Trenton, New Jersey, in connection with the paper by Prof. Chester.

The Academy then adjourned to inspect the minerals.

J. F. KEMP,
Secretary.

ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE 253d regular meeting of the Anthropological Society was held Tuesday, the 17th of November, 1896.

Dr. J. H. McCormick read a paper on a 'Primitive Village Site in Maryland,' in which he described a discovery of an Indian village site recently made by him, in Montgomery county, Md., about thirty miles from Washington. He exhibited a collection found upon, and near the site, which illustrated perhaps, better than any other collection, the contemporaneous existence of the rude chipped stone implements and the most highly polished stone implements associated together, which substantiates Prof. W. H. Holmes's claim of the contemporaneity of the Palæolithic and neolithic ages. It was also noted that these implements, contrary to the usual rule, increased in this region, as we approached the interior, and that the camp site was always situated northeast from water supply, whether spring or stream.

The implements were discussed at some length, and compared to many specimens found in various parts of the United States. For the most part they were of stone not found in the vicinity. Several ceremonial stones, of exquisite workmanship, were of the Tennessee slate and one a phallus. The paper was discussed by Messrs. McGee, Thos. Wilson, Pierce, Blodgett, Cushing and Mason.

Mr. Cushing read a paper on the 'Shell Mound Explorations from Maine to Florida,' in which he described the recent explorations of the shell heaps in Maine and Florida. He exhibited a beautiful collection from the Florida coast and described the Pile dwellings and artificial islands and inlets made by these primative people. The specimens were found in the peat and marl beds of the Mangrove swamps and were obtained with much difficulty owing to the inflow of water into the excavations. The specimens showed the soaked condition in which they had existed for centuries, and upon drying, cracked and shrunk to such an extent, that many specimens broke into innumerable pieces. Among the most unique and beautiful specimens were the masks, of which water color drawings had been made as soon as they were taken from their bed, for by the following day the shrinkage had so disturbed them as to have lost their beauty.

Mr. Cushing called attention to the fact that there were no bows used, but throwing sticks instead and that the inhabitants were related to the southern and not to northern Indians, and suggested that perhaps the Seminoles were the survivors of this ancient race of people. The collection, as a whole, was the most striking and valuable ever found in these regions.

J. H. MCCORMICK,
Secretary.

GEOLOGICAL CONFERENCE OF HARVARD UNIVERSITY.

October 13, 1896.—'The Eruptive Rocks of Sussex County, N. J.' By J. E. Wolff.

'Note on the proposed Excursion to the Coastal Plain of Southern Maine.' By. W. M. Davis.

October 20, 1896.—'The Excursion to Hoosac Mountain' (illustrated with stereopticon). By J. E. Wolff.

'Some Features of the Cornwallis Valley, Nova Scotia.' By V. R. Marsters.

'Exhibition of the New Two-circle Goniometer.' By Charles Palache.

'Note on the Hurricane of October 10–14.' By R. De C. Ward.

October 27, 1896.—'Recent Accessions of Geological Material.' By W. M. Davis.

'On an Instrument for inclining a Preparation in the Microscope.' By T. A. Jaggar, Jr.

November 3, 1896.—'Review of the Excursion to Nahant.' By N. S. Shaler.

'The Tourmalines of Mt. Mica, Maine.' By Charles Palache.

'A remarkable Joint Specimen from Somerville, Mass.' By J. B. Woodworth.

Prof. Joseph LeConte was present at this meeting and gave some interesting reminiscences of the early days of the Lawrence Scientific School, from which he was one of the first graduates.

November 10, 1896.—'Material illustrating the Appendages of Trilobites.' By R. T. Jackson.

'The Excursion to the Blackstone Valley.' By J. B. Woodworth.

November 17, 1896.—'Magnetic Observations in Geological Mapping.' By H. L. Smyth.

T. A. Jaggar, Jr.,
Recording Secretary.

THE ONONDAGA ACADEMY OF SCIENCE.

The Society held its first regular meeting Friday, November 20, 1896. The President, Dr. Charles W. Hargitt, of Syracuse University, delivered an inaugural address, defining the 'Aims and Purpose of the Academy.' He considered the 'creation and cultivation of science, the dissemination of knowledge and the acquirement of a depository for everything scientific' the chief aims of the Academy. Mr. Horace W. Britcher gave a short talk, entitled: 'A Summer Laboratory on the Coast of Maine,' which was amply illustrated with photographs and alcoholic specimens.

The Onondaga Academy was organized October 24, 1896, the constitution and by-laws being adopted at that time. The Academy is the outgrowth of the scientific committee of the Onondaga Historical Association, which held scientific meetings throughout the summer, attracting numerous scientific workers from the vicinity. It has a charter membership of twenty-one. The well-known reputation of central New York, in the various scientific branches, gives considerable range to the work of the Academy, which has started out under most auspicious circumstances.

Philip F. Schneider,
Secretary.

NEW BOOKS.

The Gases of the Atmosphere: The History of their Discovery. William Ramsay. London and New York, The Macmillan Co. 1896. Pp. viii+240. $2.

Bibliographia Physiologia, 1895. Ch. Richet. Paris, Félix Alcan. 1896. Pp. 896. 3 fr. 50.

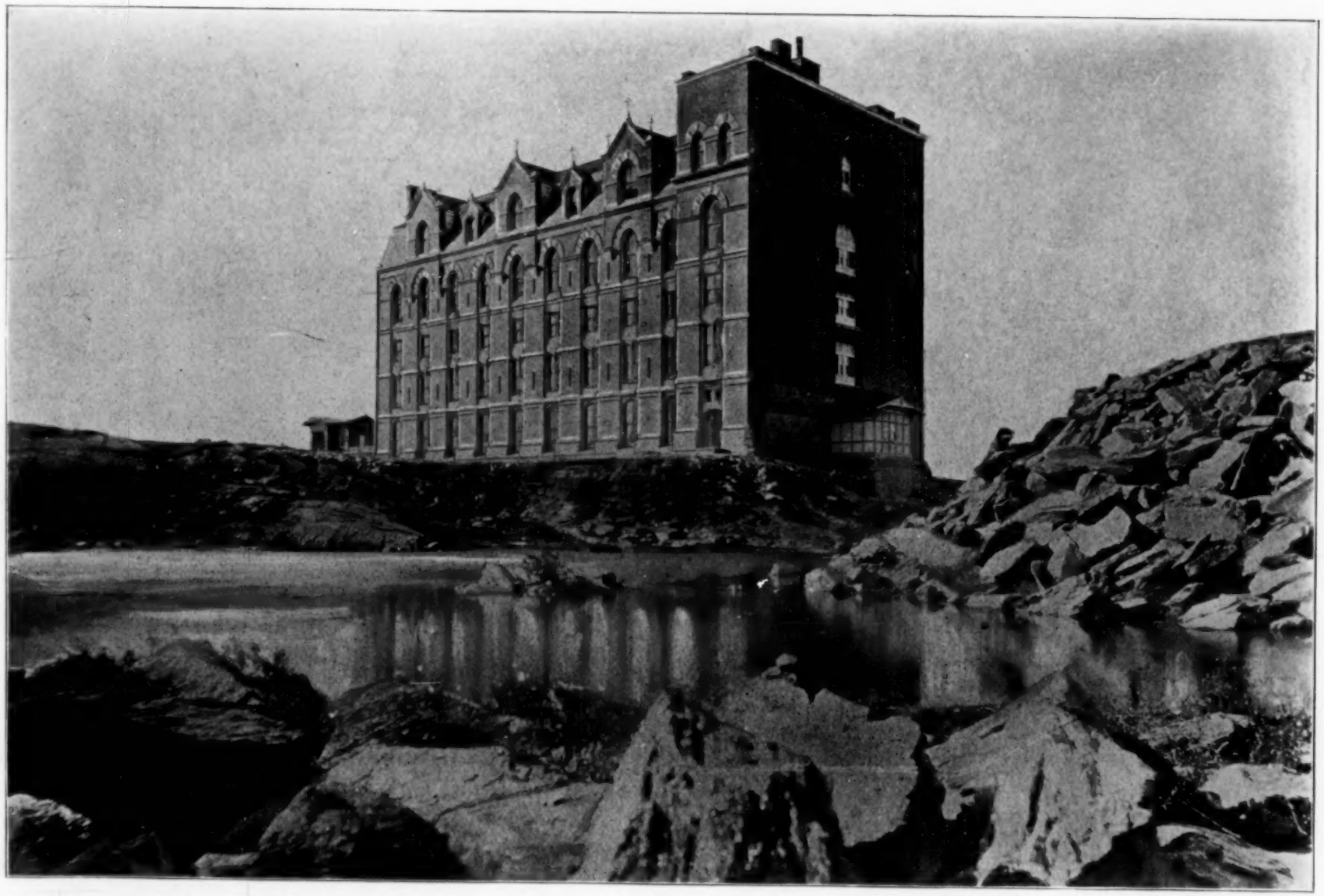
Papers presented to the World's Congress on Ornithology. Edited by Mrs. Irene Rood, under the direction of Dr. Elliott Coues. Chicago, Charles H. Sergel Co. 1896. Pp. 208. $5.

Les Aryens au Nord et au Sud de l'Hindou-Kouch. Charles de Ujfalvy. Paris, G. Masson. 1896. Pp. xv+488.

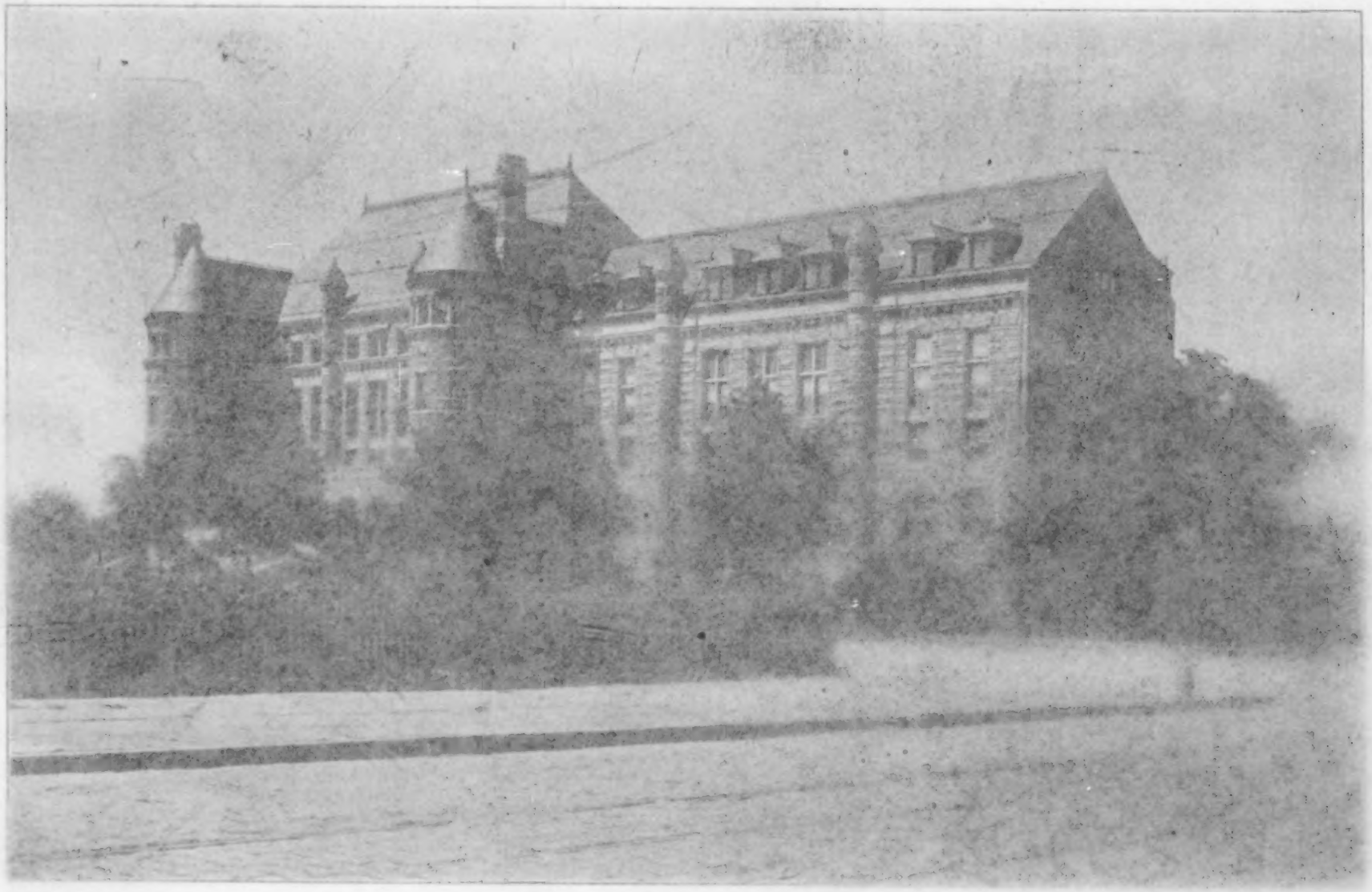
Round the Year, A Series of Short Nature Studies. L. C. Miall. London and New York, The Macmillan Co. 1896. Pp. viii+295. $1.50.

Sixteenth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1894–95. Charles D. Walcott, Director. In four parts: Part I.—Director's report and papers of a theoretic nature. II.—Papers of an economic character. III.—Mineral resources of the United States, 1894; metallic products, David T. Day, Chief of Division. IV.—Mineral resources of the United States, 1894; nonmetallic products, David T. Day, Chief of Division. Vignette. Washington Government Printing Office. 1896. [II.. III. IV., 1895.]

Cambridge Natural History. Vol. II. London and New York, The Macmillian Co. Pp. xii+560. $3.50.

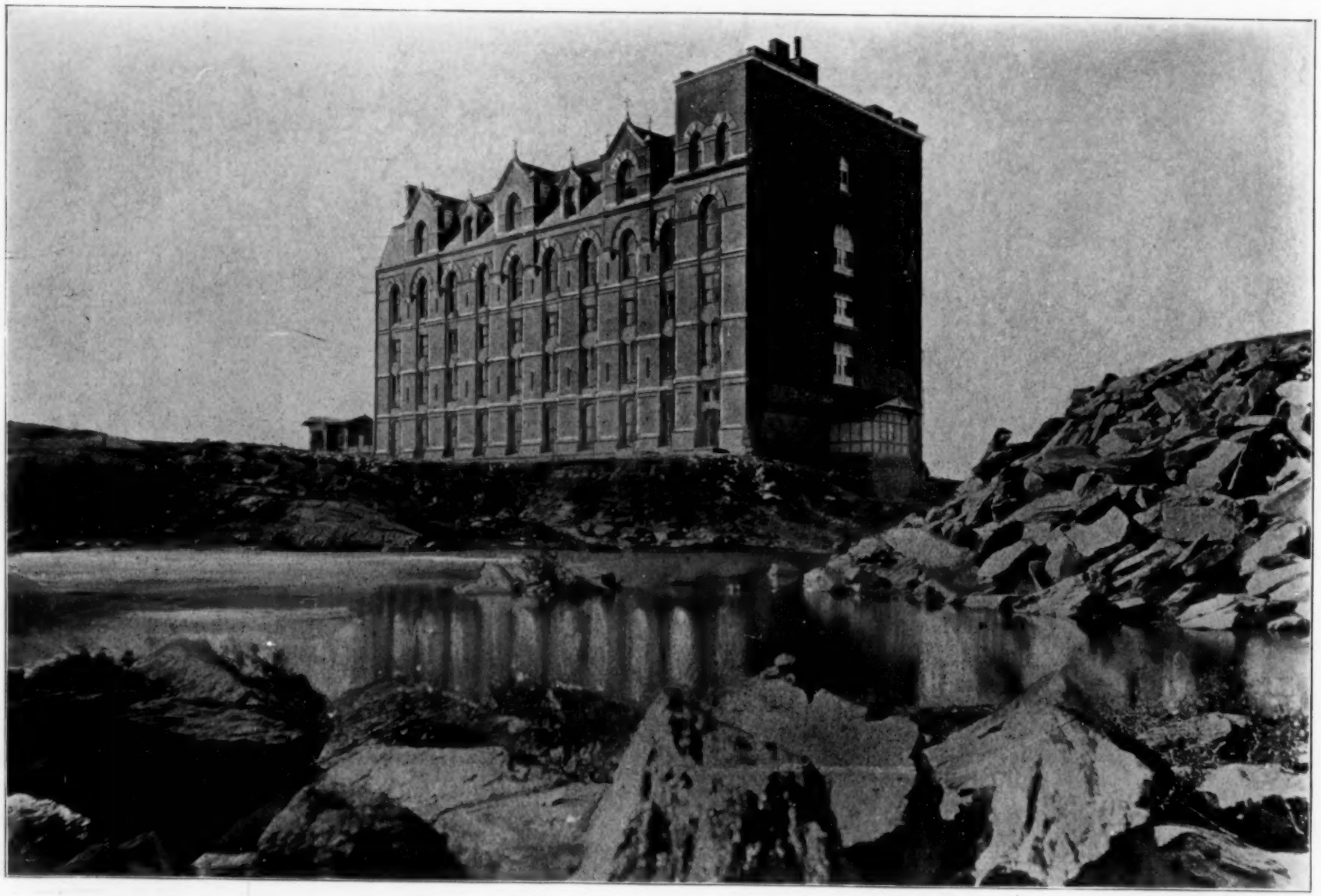


View of Museum Building, 1878.

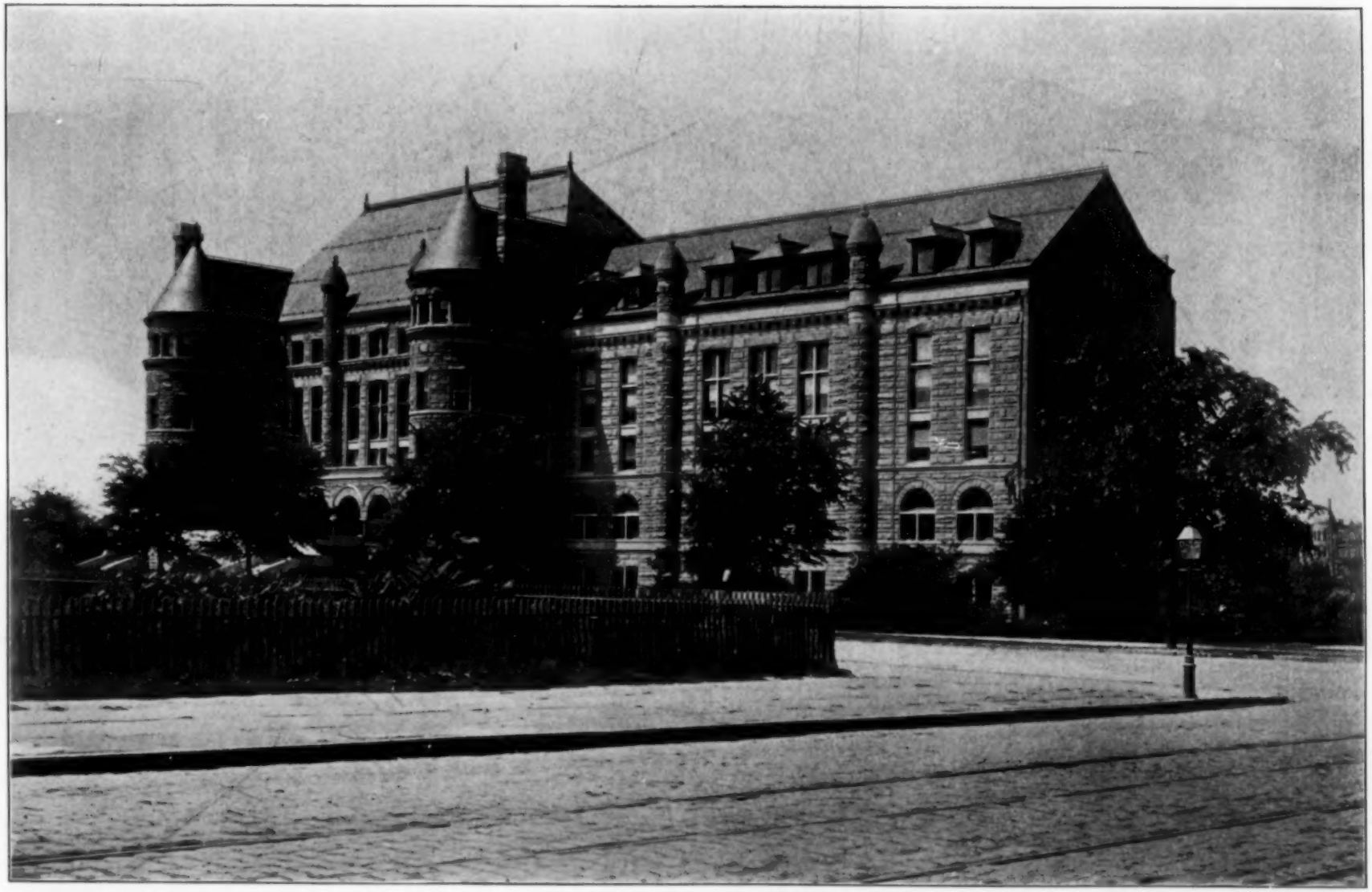


L. G. GALEY, PHOTO.

VIEW OF MUSEUM BUILDING, WITH EAST WING, 1904.



VIEW OF MUSEUM BUILDING, 1878.



L. C. LAUDY, PHOTO.

VIEW OF MUSEUM BUILDING, WITH EAST WING, 1894.